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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Directory of the Office of Management and Budget through September 30, 1983.

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PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

OXYGEN-18 AND DEUTERIUM DETERMINATION ON A SINGLE WATER SAMPLE OF A FEW MILLIGRAMS,
Okayama Univ. (Japan). Inst. for Thermal Springs Research.
N. Kishima, and H. Sakai.
Analytical Chemistry, Vol 52, No 2, p 356-358, February, 1980. 1 Fig, 1 Tab, 20 Ref.

Descriptors: *Isotope studies, *Oxygen isotopes, *Deuterium, Water analysis, Hydrogen isotopes, Micro carbon dioxide-water equilibration technique.

A simple micro carbon dioxide-water equilibration technique was developed for the precise analysis of the O18/O16 ratio. The water sample and CO2 are frozen in a cavity in the equilibration vessel and allowed to equilibrate for a specified period. Upon warming, the carbon dioxide and the water condense into two separate rings. The carbon dioxide is liberated from the trap, and the water component is converted to hydrogen in a uranium furnace. Both CO2 and hydrogen samples are then subjected to isotopic analysis by mass spectrometry. The O isotope analysis was within + or - 0.1% of the given value in 13 of 16 runs; that of deuterium, within + or - 1% in 9 of 16 analyses. (Cassar-FRC)
W83-02651

1B. Aqueous Solutions and Suspensions

ENERGY ASPECTS OF EQUILIBRIUM CO-CRYSTALLIZATION FROM AQUEOUS SOLUTION,
Akademiya Nauk SSSR, Moscow. Inst. Geokhimii i Analiticheskoi Khimii.
For primary bibliographic entry see Field 2K.
W83-02585

THE HYDROPHOBIC INTERACTION IS LONG RANGE, DECAYING EXPONENTIALLY WITH DISTANCE,
Australian National Univ., Canberra. Dept. of Applied Mathematics.
J. Israelachvili, and R. Pashley.
Nature (London), Vol 300, No 5890, p 341-342, November, 1982. 2 Fig, 22 Ref.

Descriptors: *Mathematical studies, *Physical properties, *Solutions, Organic compounds, Water properties.

The forces between two hydrophobic surfaces in aqueous solutions were measured in the distance range D=O to D 50 nm. The experimental techniques used were similar to those used earlier to measure the forces between mica surfaces in liquids, which allow the force between two crossed cylinders of mica to be measured with a distance resolution of about 0.2 nm. It was noted that the hydrophobic interaction acts over the long range and cannot be considered as arising from any bond-like association. For two surfaces 50% of the total interaction free energy occurs at distances beyond about two water molecule diameters. The exponential dependence of the interaction has been predicted in recent theories of solvation forces. The long-range attractive forces measured between surfactant and lipid bilayers where both hydrophilic and hydrophobic groups are present at these interfaces appear to be well described by the van der Wals dispersion force, suggesting that the hydrophobic interaction is neutralized when the local structure of water molecules is dominated by their interaction with nearby hydrophilic groups. (Baker-FRC)
W83-02778

2. WATER CYCLE

2A. General

THE GENESIS OF A NUMERICAL MODEL FOR THE STUDY OF THE HYDROGEOLOGY OF A STEEP HILLSIDE IN HONG KONG,
Hong Kong Public Works Dept. Geotechnical Control Office.
B. Leach, and R. Herbert.
Quarterly Journal of Engineering Geology, Vol 15, No 3, p 243-259, 1982. 19 Fig, 1 Tab, 17 Ref.

Descriptors: *Slopes, *Model studies, Numerical models, *Hydrogeology, *Evapotranspiration, Soil water, Rainfall infiltration, Mathematical models, Hills, Hydrodynamics, Mathematical studies, *Hong Kong, Slope stability.

A finite, forward-difference numerical model was developed to aid in studying the hydrology of a steep hillside in Hong Kong. Model calculations were based on contours of the highest observed elevations of the main groundwater table during the 1979 and 1980 wet seasons. Since hydraulic gradients were steep and flow was rapid downslope, a two dimensional time variant representation was used. Calibration of the model against observed piezometric responses during the 1980 wet season has shown the importance of indirect recharge from bedrock in sustaining the system. The vital role of evapotranspiration in assessing direct recharge from rainfall to the system was also demonstrated. The model may be applied to the estimation of extreme water levels as input for slope stability analysis problems. An analysis of model discretization errors is presented. (Geiger-FRC)
W83-02474

ORDER SELECTION OF AR MODELS OF HYDROLOGIC TIME SERIES,
North Dakota State Univ., Fargo. Dept. of Civil Engineering.
G. Padmanabhan, and A. R. Rao.
Nordic Hydrology, Vol 13, No 2, p 93-104, 1982. 3 Fig, 1 Tab, 36 Ref.

Descriptors: *Hydrologic models, *Time series analysis, *Regression analysis, *Probabilistic process, *Model testing, Model studies, Mathematical studies, Mathematical models, Statistical methods, Decision making, *Autoregressive models.

The Akaike's Information Criterion (AIC) has been widely used for the determination of order of autoregressive (AR) models of hydrologic time series modeling, despite the fact that it is statistically inconsistent. Several other decision rules have been proposed for selecting orders of AR models, and several are analyzed by both hydrologic and nonhydrologic time series. One such rule, the Posterior Probability rule, is statistically consistent and possesses optimality. The Posterior Probability rule can also estimate the probability of selecting the correct model. Although the orders of AR models given by the various decision rules are not very different in many of the 12 time series analyzed, the Posterior Probability criterion is preferred due to its properties of optimality and asymptotic consistency. (Geiger-FRC)
W83-02476

REMOTE SENSING DETERMINATION OF HYDROGRAPH RECESSION CHARACTERISTICS,
Idaho Univ., Moscow. Dept. of Civil Engineering.
G. A. Willett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186627, Price codes: A02 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, February 1983. 15 p, 1 Fig, 1 Tab, 35 Ref. OWRT A-086-IDA(1), 14-34-0001-2114.

Descriptors: *Remote sensing, Hydrology, Base flow, Photogrammetry, *Basin characteristics, Precipitation, Groundwater, Literature reviews, Minimum flow.

A review of literature indicates that little work is being done on determining base of minimum flows from basin characteristics using remote sensing techniques. The majority of the work being done on base flows is by the use of mathematical models using information that can be obtained from topographic maps. Remote sensing techniques have been used mainly for determining water quality, inventories, and determing hydrological characteristics that could be determined from topographic maps as well. The effects of vegetation cover, unique geological factors, moisture content of soil, and weather patterns are recognized but not utilized within the mathematical models. Information obtainable by the use of remote sensing should be useful for revising existing mathematical models to provide more accurate predictions of not only base or minimum flows but of average and peak flows.
W83-02487

THE EFFECTS OF SNOW COMPACTION ON WATER RELEASE AND SEDIMENT YIELD-BRIDGER BOWL SKI AREA, GALLATIN COUNTY, MONTANA,
Montana State Univ., Bozeman. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2C.
W83-02491

DESIGN AND ANALYSIS OF URBAN STORM DRAINAGE - THE WALLINGFORD PROCEDURE,
Civil Engineering (London), p 41,43, March, 1982.

Descriptors: *Urban drainage, Model studies, *Rainfall-runoff relationships, *Storm runoff, *Storm drains, *Hydraulic design, *Computer models, Urban runoff, Urban hydrology, Simulation anlysis, Surface runoff, Wallingford procedure, Computers.

After five years of research, a working party at the Hydraulics Research Station produced a five volume report on the design and analysis of urban storm drainage called the Wallingford Procedure. The report covers four new methods of analysis along with computer programs for implementing the new procedures. The Wallingford modified rational method gives a value of peak discharge and may be used with or without a computer. The computer version includes the facility to represent storm overflows. The Wallingford Hydrograph method, a computer-based hydrograph method, incorporates separate models of the surface runoff and pipe-flow phases. The Wallingford Optimizing method, a computer-based method, incorporates the optimized design of pipe depth and gradient as well as diameter. The Wallingford Simulation method, also a computer-based method, monitors the performance of an existing system or proposed design when operating under surcharged conditions. The programs were tested at the Hydraulics Research Station for their applicability to typical urban drainage problems and their reliability and accuracy in simulating observed rainfall runoff events. Results showed that the Wallingford programs proved as accurate as or more accurate than existing models for simulating factors of urban runoff. However, since all the models had some limitations in predicting minute details of the rainfall-runoff process, considerable caution should be taken in using them for interpretation of single urban runoff events. (Geiger-FRC)
W83-02550

MODIFIED RUNOFF CURVE NUMBERS FOR SUGARCANE AND PINEAPPLE FIELDS IN HAWAII,
Agricultural Research Service, Boise, ID. Northwest Watershed Research Center.
K. R. Cooley, and L. J. Lane.
Journal of Soil and Water Conservation, Vol 37, No 5, p 295-298, September/October, 1982. 5 Tab, 9 Ref.

Descriptors: *Rainfall-runoff relationships, *Erosion control, *Farm management, Land management, Erosion, *Sugarcane, *Pineapple, Watersheds, Ground cover, *Hawaii.

Group 2A—General

Runoff curve numbers for sugarcane and pineapple fields in Hawaii were derived from rainfall and runoff data collected during a 7 year study between 1972 and 1979. The new curve number values were used to modify previously determined values based on 5 years of data and to adjust Soil Conservation handbook values. Handbook values were based mainly on experience obtained under mainland conditions and soils. The data-based curve numbers were slightly lower than previously used handbook values for sugarcane fields. The greatest differences were for porous A soils and complete cover conditions. The data based curve numbers were considerably lower than handbook values for pineapple fields, where field roads occupied 11 to 20% of the area. The greatest differences were noted after pineapple had reached the partial or complete cover stage, indicating that pineapple provides more protection than expected once it covers at least 50% of the field surface. Observations suggest that major portions of the runoff come from field roads, for which curve numbers are two to three times greater than those derived from the cropped area. (Baker-FRC)
W83-02706

THE EFFECT ON STORM RUNOFF RESPONSE OF SEASONAL VARIATIONS IN CONTRIBUTING ZONES IN SMALL WATERSHEDS,
Trent Univ., Peterborough (Ontario).
C. H. Taylor.
Nordic Hydrology, Vol 13, No 3, p 165-182, 1982. 8 Fig, 4 Tab, 24 Ref.

Descriptors: *Storm runoff, *Seasonal variations, *Watersheds, Runoff, Rainfall-runoff relationships, *Ontario, Canada, Wetlands, Snowmelt, Infiltration, Soil properties.

Storm runoff production by saturation overland flow has been studied in two small watersheds in south central Ontario. One watershed is classified in two small watersheds in south central Ontario. One watershed is classified as having rural land use and contains a wetland. Here the total saturated zone is at its maximum extent during spring snowmelt, when the overwhelming majority of total runoff and quickflow is produced. The stream seldom flows during the summer and winter seasons, but does so occasionally in the fall if the wetland is recharged sufficiently. Simple calculations show that the storm-to-storm variations in quickflow response are controlled by the extent of surface soil saturation (measured by field mapping and correlated with antecedent wetness variables) and precipitation amount. The other watershed has been undergoing suburban development since 1973. Quickflow response during summer and fall seasons has not appreciably changed since then, although 30% of the watershed surface has been disturbed. This is because in those seasons quickflow is still produced as saturation overland flow from the original contributing zones alongside the stream. In contrast, during spring snowmelt the very wet soil conditions and a high water table allow the disturbed surfaces with low infiltration capacities to be integrated into the contributing area via normally dry drainage lines. As a result spring quickflow has increased by three to four times over the original values. (Baker-FRC)
W83-02779

2B. Precipitation

LOS ANGELES RAINFALL FREQUENCIES CHANGE AS RECORD LENGTHENS,
California State Univ., Northridge.
A. Court, and W. Reid.
Monthly Weather Review, Vol 110, No 1, p 44-45, January, 1982. 1 Fig, 1 Tab, 1 Ref.

Descriptors: *Rainfall, *Frequency analysis, *Climatology, *Los Angeles, *Rainfall intensity, Precipitation, Mathematical studies, Regional analysis, Frequency distribution, Probability distribution, Hydrometeorology, *California.

Previous research by Showalter (1948) based upon tabulations of 70 years of wet and dry rainfall years at Los Angeles (1877-78 through 1947-48) showed the presence of three 33 or 34 year precipitation classes. In the first sequence, 6 wet, 5 normal, and 5 years were identified. Each of thes sequences was followed mostly by dissimilar sequences in the first 33 years. In the next 33 years, the trend was reversed, so that wet-wet, normal-normal, and dry-dry pairs occurred. The later 33-year period was a little drier than the first 70 years. Previous finding claimed that like-like successions were less frequent than might be expected at Sacramento, Louisville, Denver, and Salt Lake City, but more frequent at San Diego, Albany, St. Louis, Washington, D. C., and New York City. Examination of the last 33 years of a 103 period at Los Angeles shows that these findings may be doubtful. Showalter concedes his previously drawn conclusions to the present findings, which indicate a change in the rainfall frequencies of Los Angeles as the record is lengthened. (Geiger-FRC)
W83-02472

USE OF THE EXTREMAL-3 DISTRIBUTION IN PRECIPITATION EVALUATION AND LOW WATER ANALYSIS (DIE ANWENDUNG DER EXTREMAL-3-VERTEILUNG BEI DER REGENAUSWERTUNG UND DER NIEDRIGWASSERANALYSE),
Dorsch Consult G.m.b.H., Munich (Germany, F.R.).
W. Koniger.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 10, p 460-466, October, 1981. 4 Fig, 1 Tab, 31 Ref.

Descriptors: *Mathematical studies, *Distribution, *Precipitation, Rainfall, Precipitation distribution, Mathematical equations, Flow.

The basic relationships for the extreme-value type-3 distribution are reviewed. The shortcomings of fitting the distribution by the method of moments or regression are discussed. It is noted that up to now the application of the Maximum Likelihood method to the extreme-value type-3 distribution has been made using the wrong assumptions. Using the principle of maximum entropy, derived from the mathematical theory of information, it is shown that the two simple equations provide unbiased estimates of the paramters of extreme-value distributions. The inferences are illustrated by examples of annual series of low flow and partial duration series of precipitation data. (Baker-FRC)
W83-02590

GROUND-WATER RECHARGE RATES IN MINNESOTA AS RELATED TO PRECIPITATION,
Minnesota Geological Survey, St. Paul.
For primary bibliographic entry see Field 2F.
W83-02730

ACIDIFICATION OF GROUNDWATER IN NORWAY,
Norsk Inst. for Vannforskning, Oslo.
For primary bibliographic entry see Field 2K.
W83-02793

DETECTION OF RAINFALL RATES UTILIZING SPACEBORNE MICROWAVE RADIOMETERS,
Environmental Research and Technology, Inc., Concord, MA.
H-H. K. Burke, K. R. Hardy, and N. K. Tripp.
Remote Sensing of Environment, Vol 12, No 2, p 169-180, 1982. 8 Fig, 3 Tab, 11 Ref.

Descriptors: *Rainfall rate, *Measuring instruments, *Radiometry, Microwave radiometers, Mie theory, Rainfall, Remote sensing.

Raindrops both absorb and scatter radiation over most of the microwave spectrum, producing large changes in brightness temperatures relative to clear or cloudy conditions. Since the structure of rain varies substantially for different rain rates and climatological backgrounds, the raindrop size distribution, the rain layer thickness and the ice clouds above the rain layer are all important inputs to the model computations. The subsequent modeling involves applying the Mie theory to derive the absorption and scattering effects and the radiative transfer computations to derive the brightness temperature. Over ocean background lower frequencies are sufficiently sensitive to rain conditions. Over land background, higher frequencies are needed to obtain the sensitivity to rain rates. By using discrimination tests of the radiometric data, the rain/no rain decision can be made and the rainfall rate can be retrieved from a statistical inversion technique. The shortcomings of this technique are: the assumption of a homogeneous field of view at different wavelengths can be erroneous, the actual physical structure of the rain layer may be significantly different from the one used in the climatological approach, and additional uncertainty may be introduced because of the limitations of the radiative transfer algorithm. (Baker-FRC)
W83-02798

2C. Snow, Ice, and Frost

IDENTIFICATION OF SNOWCOVER DEPLETION PATTERNS USING SATELLITE IMAGERY,
Idaho Univ., Moscow. Dept. of Engineering Science.
L. F. Heitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186122, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, February 1983. 30 p, 3 Fig, 5 Tab, 14 Ref. OWRT A-082-IDA(1), 14-34-0001-2114.

Descriptors: *Remote sensing, Satellites, *Snow cover, Snowmelt, Ablation, Streamflow forecasting, Runoff forecasting, *Idaho, Boise Basin.

The purpose of this research was to investigate whether there is a possibility of using satellite imagery to finely calibrate large scale basin runoff models. It is anticipated that by better understanding the snowcover depletion patterns in a basin the runoff models might be adjusted to better forecast both quantity and timing of runoff especially in the late stages of the snowmelt season. This forecasting of runoff is essential to the optimal operation of large multi-purpose, multi-reservoir water control systems. While no actual field or laboratory research was carried out, as a result of this project, a detailed literature review was made and contacts were made with many agency officials. The literature review, agency contacts and various parts of this report will serve as springboards in efforts to secure future funding in this research area. It appears that the Boise River Basin in Idaho would be the most likely candidate on which to develop the snowcover depletion pattern methodologies. The basin is well monitored as far as stream flows, it has a detailed hydrometerological instrumentation system and a detailed runoff model (Streamflow Synthesis and Reservoir Regulation Model, SSARR) is already operational for the basin. This report contains both project plans and budgets for complete studies of the snowcover depletion phenomena on the Boise Basin.
W83-02488

THE EFFECTS OF SNOW COMPACTION ON WATER RELEASE AND SEDIMENT YIELD-BRIDGER BOWL SKI AREA, GALLATIN COUNTY, MONTANA,
Montana State Univ., Bozeman. Dept. of Earth Sciences.
T. R. Grady, S. G. Custer, and J. Montagne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186445, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Center Report No 124, Bozeman, June 1982. 23 p, 3 Fig, 3 Tab, 5 Ref. OWRT A-126-MONT(1), 14-34-0001-0128.

Descriptors: *Snow management, *Water yield, *Surface runoff, *Sediment yield, Density, Snow storage, Snow skiing, Albedo, Avalanches, Snow hydrology, Meltwater, *Montana, Bridger Bowl.

Little is known regarding the impact of ski compaction on runoff and sediment yield in downhill ski areas. This study uses a paired watershed approach to analyze the impact of snow compaction on runoff timing, hydrograph-peak height, and sediment yield. The two basins compared are adjacent to one another and have similar basin area, geology, relief, elevation, slope, and tree cover. The compacted watershed is adjacent to Bridgewater Bowl, is unskilled, and contains no roads. Results show that compacted snow releases water to streams 7-14 days later than uncompacted snow. The basin with snow compaction had a flashier hydrograph characterized by a steeper rising limb and a higher peak discharge than the uncompacted basin. Slope runoff collectors showed similar results. The delay of snow melt from the compacted snow which reduces the rate of heat transfer by water movement, impedes the development of wet snow grains, and so delays the release of water. For the basins compared in this study, snow compaction had little effect on sediment yield.
W83-02491

EXPERIENCE IN PREDICTING ELEMENTS OF THE ICE AND THERMAL REGIME OF THE LOWER POOLS OF HYDROELECTRIC STATIONS,
S. N. Nazarenko, T. E. Kozhevnikova, and L. I. Sulimova.
Hydrotechnical Construction, No 9, p 945-949, September, 1980. 3 Fig, 1 Tab, 5 Ref. Translanted from Gidrotekhnicheskoe Stroitel'stvo, No 9, p 40-43, September, 1980.

Descriptors: *Ice formation, *Water temperature, *Reservoirs, Ice cover, Ice jams, Ice thickness, Temperature, Freezing, Hydroelectric plants, Flow velocity, Regulated flow, Environmental effects.

The ice regime in the lower pool of a hydroelectric plant depends on the temperature of the water, the magnitude of the discharge, meteorological conditions and flow characteristics. The winter coefficient (Kw) expresses the discharge capacity of the channel under the ice cover. In normal operation of large hydrostations the winter water temperature of the lower pool is close to the cross-sectional average temperature of the upper pool, despite considerable vertical stratification, The length of the polynya, or ice-free stretch below the dam, varied from 7 to 65 km in a survey of several hydrostations. Ice on the channel shores accumulates to about 25% of the total channel width in the polynya. The initial thickness of the ice cover is numerically equal to the flow velocity with flow velocities of 1 m per sec or greater and to half the velocity at velocities < 0.5-0.7 m per sec. Graphs of winter coefficients plotted against time for conditions of natural freezing in undammed rivers reveal three patterns.
W83-02621

WAVES ON GLACIERS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
A. C. Fowler.
Journal of Fluid Mechanics, Vol 120, p 283-321, July, 1982. 5 Fig, 79 Ref.

Descriptors: *Waves, *Glaciers, *Glacier surges, Surges, Glaciology, Geophysics, Fluid mechanics, Hydrodynamics, Mathematical equations.

A mathematical synopsis of the theory of wave motions on glaciers is presented. These include surface waves and seasonal waves. The present thesis is that the two wave motions can both be derived from a rational theory based on conservation laws of mass and momentum, provided that the basal kinematic boundary condition involving boundary slip is taken to have a certain reasonable form. It is suggested that the form of this 'sliding law' is the crux of the difference between seasonal and surface waves, and that a further understanding of these motions must be based on a more satisfactory analysis of basal sliding. Ice is treated here in the context of a slow, shallow, non-Newtonian fluid flow, and therefore the theory that emerges is that of non-Newtonian viscous shallow-water theory; rather than balance inertia terms with gravity in the momentum equation, the shear-stress gradient is balanced. The resultant equations are a first-order nonlinear hyperbolic wave equation, susceptible to various kinds of analysis. It is demonstrated how both surface and seasonal waves are naturally described by such a model when the basal boundary condition is appropriately specified. Shocks can naturally occur, and the small diffusive parameters that are present are identified, and the shock structure given. This presents a useful understanding of the effects of surface slope and longitudinal stress in these waves. (Baker-FRC)
W83-02699

MEASUREMENT AND MODELING OF MICROWAVE EMISSION FROM FORESTED SNOWFIELDS IN MICHIGAN,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
D. K. Hall, J. L. Foster, and A. T. C. Chang.
Nordic Hydrology, Vol 13, No 3, p 129-138, 1982. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Model studies, *Measuring instruments, *Snow depth, Snow cover, Snowpack, Snow mantle, Snow density, Satellite technology, Forests, Soil moisture, Remote sensing, Data collections, *Michigan.

The microwave emissivity of snowcovered forests was analyzed, and subsequently a Nimbus-7 SMMR (Scattering multichannel microwave radiometer) data collection was used in a microscopic scattering model to substract the effects of the forest cover from the microwave brightness temperature (TB)/snow depth relationship in the lower peninsula of Michigan. Forest cover confused the normally inverse relationship between TB and snow depth in dry snowpacks. However, even in the presence of forest cover the average 37 GHz vertically and horizontally polarized TBs from Nimbus-7 were 11 and 19 degrees K lower during the study period in February of 1979 versus February of 1980. This is attributed to deeper average snowcover for the 1979 study period. The brightness temperature was correlated with snow depth for the study periods in 1979 and 1980, resulting in positive relationships instead of the expected inverse relationships. It is assumed that the emissivity of the forest cover overwhelmed that of the snow in both years, causing higher TBs in more heavily forested areas. A simple model was used to remove the effects of the trees from the relationship. A new value, residual brightness temperature, TBR, derived from the 37 GHz data, was correlated with snow depth for selected time periods in February resulting in inverse relationships. SMMR data of August 1979 were correlated with percent forest cover to determine the TB of the study area in the absence of snow. The lower SMMR frequencies showed statistically significant inverse relations with forest cover during the August study period. These were due to increased soil moisture in the more heavily forested areas in the northern half of the lower peninsula of Michigan, thus causing lower TBs. (Baker-FRC)
W83-02774

AREAL DIFFERENTIATION OF LAND AND LAKE SNOWCOVER IN A SMALL SUB-ARCTIC DRAINAGE BASIN,
Trent Univ., Peterborough (Ontario).
W. P. Adams, and N. T. Roulet.
Nordic Hydrology, Vol 13, No 3, p 139-156, 1982. 7 Fig, 4 Tab, 23 Ref.

Descriptors: *Snowcover, *Drainage basins, *Polar regions, Canada, *Labrador, Elizabeth Lake, Spatial distribution, Distribution, Hydrology, Lake ice.

A large, stratified, random sample was used to identify vegetation related patterns of snowcover and patterns of land and lake snowcover properties in the basin of Elizabeth Lake, Labrador, Canada. Spatial patterns of snow depth, density and water equivalent are discussed using analyses of variance and trend surface analyses. Statistically significant relationships are demonstrated between these properties and four distinctive landscape units, Tundra, Open Lichen Woodland, Close Lichen Woodland and Lake. The mid-winter lake snowcover displays special features. The low mean water equivalent of lake snowcover reflects both marked deflation and slushing. The hypothesis that wind removal from the landscape unit, as distinct from redistribution within the unit, is a marked feature of the Lake environment could only be confirmed with information on the density of snow incorporated into lake ice. The Lake snowcover exhibited quite marked spatial trends, e.g., in the snow depth pattern, at the time of the survey. The spatial trends of white ice (frozen slush) are readily predictable. It was clear that factors other than vegetation control snowcover in the basin, including topography, altitude, aspect and non-vegetative surface roughness. The trend surface analyses hinted at some of these effects, including upwind-downwind patterns in the basin, but marked broad scale wind effects were only present on the lake. The survey system used appears to be useful for hydrologic work. (Baker-FRC)
W83-02775

2D. Evaporation and Transpiration

SURFACE TEMPERATURE MODEL FOR EVAPORATION PANS (MODELISATION DE LA TEMPERATURE DE SURFACE DES BACS EVAPOROMETRIQUES),
Faculte des Sciences Agronomiques de l'Etat, Gembloux (Belgium). Lab. d'Hyraulique.
P. Dehon.
Journal of Hydrology, Vol 49, No 3/4, p 369-384, February, 1981. 14 Fig, 9 Ref.

Descriptors: *Evaporation pans, *Water temperature, *Mathematical models, *Pan evaporation, Evaporation, Evaporation rate, Air temperature, Wind velocity, Atmospheric pressure, Solar radiation.

A simple method is presented to estimate the surface temperature of evaporation pans. The model requires the measurement of the following climatological variables: the shortwave radiation of the sun, the air temperature, the actual vapor pressure, the relative sun light, and wind speed. The method is valid for shallow and deep (depth between 0.20 m and 2.0 m). The model also describes the daily development of surface temperature in terms of the energy balance. (Author's abstract)
W83-02673

A PRELIMINARY QUANTIFICATION OF THE IMPACTS OF ASPEN TO CONIFER SUCCESSION ON WATER YIELD WITHIN THE COLORADO RIVER BASIN (A PROCESS AGGRAVATING THE SALT POLLUTION PROBLEM),
Utah State Univ., Logan. Coll. of Natural Resources.
G. F. Gifford, W. Humphries, and R. A. Jaynes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191916, Price codes: A04 in paper copy, A01 in microfiche. Utah Water Research Laboratory Hydraulics and Hydrology Series UWRL/H-83/01, Utah State Univ., Logan, January 1983. 67 p, 24 Fig, 8 Tab, 63 Ref. OWRT B-175-UTAH(1), 14-34-0001-9138.

Descriptors: *Evapotranspiration, Forest hydrology, Forest management, Succession, *Conifers, Spruce, Fir, *Aspen, Transpiration, Vegetation effects, *Colorado River Basin, *Water yield, *Water yield improvement, *Utah, Chicken Creek watershed, Water budget, Plant succession.

Quaking aspen cover 3.3 million hectares in the Upper Colorado River Basin, and these areas are gradually converting to conifer forest by the natural process of ecological succession. This change is being hastened by forest managment practices that reduce fires, destroy pests, or otherwise prevent the natural processes that previously caused conifer areas to revert to the subclimax aspen. The hydrologic consequence has been forecast to cause a runoff reduction in the Colorado River as large

as one million acre-feet annually, a major blow to water availability in the Lower Basin. Understanding and dealing with the problems requires quantitative comparision of the evaportranspiration rates of conifer and aspen forests under a variety of conditions. For this comparison, heat pulse velocity techniques were developed for monitoring water movement in aspen (Populus tremuloides), subalpine fir (Abies lasiocarpa), an Englemann spruce (Picea engelmannii). Once the techniques were perfected, transpiration was monitored in trees of each species for one year. The data were used to estimate crop coefficients by time of year for each species within the model ASPCON, a deterministic, lumped-parameter model describing the hydrology of aspen to conifer succession. The results for one location indicate a 7.3 in. net loss in streamflow when spruce replace aspen, and net loss of 2.8 in. when fir forests cover a watershed. Aspen began using significant amounts of water a month or two later in the spring and thus are associated with much higher spring runoff. While details vary greatly with location, the aspen to conifer successional trend is significantly reducing water yields within the Colorado River Basin. W83-02737

WEEKLY WATER USE ESTIMATES BY CROPS AND NATURAL VEGETATION IN INDIANA,
Purdue Univ., Lafayette, IN. Agricultural Experiment Station.
J. E. Newman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191924, Price codes: A03 in paper copy, A01 in microfiche. Station Bulletin No 344, November 1981. 25 p, 1 Fig, 21 Tab, 3 Ref. OWRT A-999-IND(7).

Descriptors: *Evapotranspiration, *Crop water use, *Temperature, *Water use, Consumptive use, *Indiana, Climatogical areas, Data collections, *Thornthwaite method.

The Thronthwaite Method is used for estimating the weekly evapotranspiration for nine climatological divisions and crop reporting districts in Indiana. The estimates are based on possible mean weekly temperature values with proper weekly day length corrections during the growing season. The data begins with the climatogical week of March 1 to 7 and continues through 40 weeks of early December. There are 21 tables. Table 1 is based on 30 year average weekly temperatures for all 9 climatogical divisions. Tables 2 through 11 are based on 1 to 10 F above average weekly temperature deviations. Tables 12 to 21 are based on 1 to 10 F below average weekly temperature deviations. These 21 data tables contain approximately 99% of all possible weekly mean air temperatures and resulting ET value estimates that are likely to occur under Indiana climatic conditions. W83-02739

2E. Streamflow and Runoff

PREDICTION OF EFFECTS OF DAILY FLOW FLUCTUATIONS ON STREAM BIOTA,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 6G. W83-02480

IDENTIFICATION OF SNOWCOVER DEPLETION PATTERNS USING SATELLITE IMAGERY,
Idaho Univ., Moscow. Dept. of Engineering Science.
For primary bibliographic entry see Field 2C. W83-02488

IMPROVEMENT OF THE ACCURACY OF PREDICTION OF STOCHASTIC MODELS OF THE OXYGEN CONCENTRATION IN RUNNING WATERS (VERBESSRUNG DER VORHERSAGEGENAUIGKEIT STOCHASTISCHER MODELLE DES SAUERSTOFFGEHALTES VON FLIESSGEWASSERN),
Technische Univ., Dresden (German D.R.).
W. Winkler, J. Beyer, and A. Gnauck.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 1, p 107-110, 1980. 1 Fig, 2 Tab, 4 Ref. (No English Summary).

Descriptors: *Model studies, Running waters, *Oxygen balance, Mathematical models, *Differential equations, *German Democratic Republic, Zwickauer Mulde river, Prediction, Simulation analysis, Forecasting.

A stochastic dynamic model formulated as a differential equation is presented for use in predicting the oxygen content of running waters. Water temperature, flow, and COD are the initial data used. With this equation, the instantaneous oxygen content is dependent on the previous events in the balancing process. At the start of the prediction, eight measured values are inserted into the equation. At a later time, two estimated oxygen values are inserted. If estimated values are replaced by measured oxygen values at certain points in time (e.g., when predetermined tolerance thresholds are exceeded or undercut), the model, which was inaccurate up to this point due to stochastic interferences, is corrected or updated. The intervals between such corrections vary during a simulation calculation and are dependent on the accuracy of the model at time t as well as on the formulation of the model itself. The model was tested for the Zwickauer Mulde river (German Democratic Republic) with oxygen values measured at 2-, 4-, 8-, and 24-hr intervals. Good predictions were achieved when actual values were inserted whenever the divergence from the tolerance level was + or - 1 mg O2/l, even with long observation intervals, although the number of corrections necessary increased with increasing observation intervals. When measurements were taken at 24-hr intervals, the model was 97.8% accurate, though the number of required corrections (120) was greater than when measurements were taken at 2-hr intervals (95.9% accuracy, 74 corrections). (Gish-FRC) W83-02658

COMPUTATION OF FLOW PATTERNS IN RIVERS,
Waterloopkundig Lab., Delft (Netherlands).
C. B. Vreugdenhil, and J. H. A. Wijbenga.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1296-1310, November, 1982. 15 Fig, 1 Tab, 19 Ref.

Descriptors: *Flow patterns, *Rivers, *Hydrodynamics, Fluid mechanics, Streamflow, Viscosity, Slope, Flood plains, Mathematical equations.

A computational method for the steady or quasisteady flow in a river with flood plains has been presented. The numerical technique has been adapted from unsteady flow models, but a different behavior is obtained due to the balance of terms in the hydrodynamic equations. The following conclusions were drawn. Lateral diffusion of momentum (viscosity) has an appreciable effect on the velocity distribution, and consequently on the total resistance or the surface slope. If sufficiently accurate values of bottom-roughness and viscosity are available, good agreement between measured and computed flow patterns and water levels may be obtained. Relatively little is known about the viscosity under various field conditions; moreover, an accurate determination of bottom roughness under field conditions is difficult. Therefore, it is important to have field measurements of velocities and water levels for calibration of both parameters. (Baker-FRC) W83-02692

FLOW COMPUTATION USING EXTRAPOLATION PROCEDURES,
Geological Survey, Reston, VA.
C. Lai.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1374-1380, November, 1982. 1 Tab, 10 Ref.

Descriptors: *Hydraulics, *Mathematical equations, *Extrapolation, Mathematical studies, Unsteady flow, Flow, Rivers, Sacramento River, Streamflow, *California.

The advantages of applying extrapolation procedures are explored through a review and examination of the method, demonstration by numerical experiments, and some analysis of related matters. The extrapolation procedure conveniently assumes that the computational error is a polynomial function of a grid interval. This makes it possible to eliminate one or more terms of lower powers of the grid interval through a linear combination operated on a set of numerical solutions using different sizes of the grid interval. Thus the order of error can be theoretically raised higher than that of the original set. Numerical experiments can be used with advantage to that of the original set. Numerical experiments can be used with advantage to test the applicability and the effectiveness of the extrapolation procedure. The specific numerical experiments conducted herein for a Sacramento River reach, together with the previous investigations and experiments in the area, indicate that the technique is a remarkably powerful and economical tool in attaining a second order result from simple linear computations. It is believed that the procedure can be sidely and effectively applied in computational hydraulics. (Baker-FRC) W83-02695

MUSKINGUM-LIKE APPROXIMATIONS FOR WATER ROUTING,
General Electric Co., Philadelphia, PA. Space Systems Div.
W. C. Peterson, and F. H. Verhoff.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1387-1393, November, 1982. 6 Ref.

Descriptors: *Model studies, *Hydrographs, *Flood control, *Muskingum methods, Flood routing, Mass.

Mathematical approximations of the conservation of mass for water in a river are used to generate formula related to the Muskingum model. For certain choices of the parameters, this model reduces to the classical Muskingum method and suggests that other choices of parameters will make the predictions of the downstream hydrograph totally dependent on the upstream information. Further, the order of approximation involved in the Muskingum method is analyzed and related to prior work. (Baker-FRC) W83-02696

QUANTIFYING SOURCE AREAS THROUGH LAND SURFACE CURVATURE AND SHAPE,
Massey Univ., Palmerston North (New Zealand). Dept. of Geography.
R. G. Heerdegen, and M. A. Beran.
Journal of Hydrology, Vol 57, No 3/4, p 359-373, June, 1982. 3 Fig, 1 Tab, 26 Ref.

Descriptors: *Maps, *Water supply, Water resources development, Hydrodynamics, Floods, Runoff, Surface flow, Slope, Hydrologic maps, Flood forecasting, *England, *Wales, Land surface curvature.

A technique is described for map analysis in identifying hydrologically active localities said to be responsible for quick-response flood runoff. These areas are recognized as areas with convergent flow paths and retarding overland slope. Measures of curvature and slope are constructed and used in a pilot-scale regression analysis with flood response quantities as dependent variables. No large improvement in predictive ability over conventional catchment characteristics was found, although the relative importance of the variables, the derived curvature maps and the techniques employed will be of interest to modellers. (Baker-FRC) W83-02702

NUMERICAL ANALYSIS OF THE TETON DAM FAILURE FLOOD,
Columbia Univ., New York.
A. Balloffet, and M. L. Scheffler.
Journal of Hydraulic Research, Vol 20, No 4, p 317-328, 1982. 5 Fig, 20 Ref.

Descriptors: *Floods, *Model studies, *Failure analysis, Dams, *Teton Dam, Mathematical equations, Channels, Flood hydrographs, Reservoirs, *Dam failure, *Idaho.

The Teton Dam failure flood is modeled with an explicit scheme in a network of channels and reservoirs, taking into consideration the progressive inundation and drying of the flood plain. Previous studies on the same flood have been made using one-dimensional models, producing averaged stage and discharge hydrographs across the flood plain. Results of the models were compared with data from field surveys made after the flood. It was found that the network analysis allowed for more accurate representation of flood propagation in a complex topography. (Baker-FRC)
W83-02703

SALTCEDAR INFLUENCE ON SEDIMENTATION IN THE BRAZOS RIVER,
Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 2J.
W83-02704

2F. Groundwater

FIELD EVIDENCE FOR SHALE MEMBRANE FILTRATION OF GROUNDWATER, SOUTH-CENTRAL MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Geology.
D. T. Long, and G. J. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190488, Price codes: A04 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State Univ., East Lansing, March 1983. 51 p, 6 Fig, 6 Tab, 45 Ref, 1 Append. OWRT A-108-MICH(1), 14-34-0001-1124.

Descriptors: *Aquifer, *Groundwater, *Geochemistry, *Bedrock, *Tritium analysis, *Michigan, Saginaw formation aquifer, Recharge, *Shale membrane filtration, Ions, Rock types.

Shale membrane filtration is the process that controls the groundwater geochemistry of part of the Saginaw Formation aquifer in south-central Michigan. This process purports that certain rock types such as shales act as semi-permeable membranes which can selectively retard the movement of dissolved ions in a water migrating through the membrane. Based on the recharge information and surficial bedrock lithology, two study areas were chosen in south-central Michigan to test the occurrence of shale membrane filtration in the Saginaw Formation. Tritium analysis of selected wells, in one area, supports the presence of local 'point recharge' through sands and gravels to sandstone at the surface of the Saginaw Formation. The other area, based on tritium analysis, does not show the presence of local point recharge. Ion ratios from bedrock waters in the two study areas were found to increase or decrease relative to each other as would be predicted by shale membrane filtration theory, laboratory experiments, and field studies. Water-rock interactions and mixing with other chemically different waters do not correctly explain the observed ion rations, or cannot explain all the ratios as does shale membrane filtration. Shale membrane filtration best explains the observed geochemistry of Saginaw Formations's waters from the study area where conditions are favorable for the occurence of membrane filtration.
W83-02483

SYMPOSIUM ON SURFACE COAL MINING AND RECLAMATION IN THE NORTHERN GREAT PLAINS, AN UPDATE ON MINE SPOILS HYDROLOGY SOUTHEASTERN MONTANA,
Montana Bureau of Mines and Geology, Butte.
W. A. Van Voast.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186486, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Report No 125, Montana State Univ. Bozeman, April 1981. 17 p, 6 Fig, 1 Tab, 3 Ref. OWRT A-113-MONT(1), 14-34-0001-9028 14-34-0001-0128.

Descriptors: *Groundwater, *Coal mining, *Strip mines, *Aquifer characteristics, Hydrologic systems, Spoil banks, Backfill, Hydraulic conductivity, Water quality, *Montana, Fort Union formation, McKay bed, Spoils hyrdrology.

Coal beds serving as important aquifers for southeastern Montana's agriculture are being removed through strip mining and replaced by rock materials (spoils). As mine pits are backfilled, water reenters the spoils establishing saturated thickness up to 40 feet where recharge from surface impoundments occurs. Hydraulic conductivities of mine spoils are similar to those of replaced coal beds. Water quality in backfilled spoils is highly diverse. Dissolved solids contents in spoils water at the Rosebud, Big Sky, and Decker mines are 64, 100, and 39% higher, respectively, than concentrations in nearby stock and domestic supplies.
W83-02495

HYDROCHEMICAL EVOLUTION OF THE EAST MIDLANDS TRIASSIC SANDSTONE AQUIFER, ENGLAND,
Institute of Geological Sciences, London (England). Hydrogeology Unit.
For primary bibliographic entry see Field 2K.
W83-02616

HYDRODYNAMIC CONDITIONS FOR COMPUTER SIMULATION OF PHYSICOCHEMICAL INTERACTIONS IN A WATER-ROCK SYSTEM IN HYDROGEOCHEMICAL FORECASTING: APPLICATION TO CAF2 WITH SOLUTIONS OF VARIOUS COMPOSITIONS,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
For primary bibliographic entry see Field 2K.
W83-02617

APPLICATION OF THE AQUIFER'S AVERAGE CHARACTERISTICS FOR DETERMINING THE ONSET OF THERMOHALINE CONVECTION IN A HETEROGENEOUS AQUIFER,
Florida Univ., Gainesville. Dept. of Civil Engineering.
H. Rubin.
Journal of Hydrology, Vol 57, No 3/4, p 321-336, June, 1982. 8 Fig, 5 Ref.

Descriptors: *Aquifer characteristics, Flow, *Thermohaline convection, Convection, Mathematical equations, Model studies, Simulation, Hydraulic resistivity, Heat diffusivity, Solute dispersion tensor.

Suggestions are offered as to how to calculate the value of an aquifer's average hydraulic resistivity, heat diffusivity, and solute dispersion tensor. All of these are represented by second-order tensors, provided that local characteristics of the aquifer vary with depth. Calculations of diffusive thermohaline convection show that the approximate method of the aquifer's average characteristics can be useful for predicting the flow field stability. The method does not supply a complete picture of all changes in the structure of the convection cell due to the aquifer heterogeneity, but values of critical and overstable Rayleigh number obtained by this method are almost identical to those obtained by accurate methods. The method of the aquifer's average characteristics was applied in this study for predicting the onset of dispersive thermohaline convection. Such a phenomenon occurs in an aquifer originally subject to hydraulic gradients, leading to horizontal flow of the groundwater. The analysis showed how variations of the principal components of the average characteristic tensors affect thhe criteria of marginal stability and overstability of the flow field. (Baker-FRC)
W83-02674

THERMOHALINE CONVECTION IN A NONHOMOGENEOUS AQUIFER,
Florida Univ., Gainesville. Dept. of Civil Engineering.
H. Rubin.
Journal of Hydrology, Vol 57, No 3/4, p 307-320, June, 1982. 3 Fig, 3 Ref.

Descriptors: *Aquifer characteristics, *Convection, *Temperature gradients, *Thermohaline convection, Aquifers, Groundwater supplies, Geothermal studies, Salinity, Hydrodynamics, *Linear stability analyis.

Linear stability analysis of the onset of thermohaline convection in a nonhomogeneous aquifer is developed. In this analysis variations of the hydraulic resistivity and heat diffusivity of the porous medium are employed. It is assumed that the parameters vary along the vertical direction. The equations which simulate the point of instability are nonlinear. Utilizing the Galerkin method when applying Fourier series expansions expressing the flow field perturbations, a set of linear homogeneous equations is obtained which yield two different secular equations related to marginal stability and overstability, respectively. It is suggested that the aquifer's properties be expressed by Fourier series expansions, mainly if these properties' profiles have points of discontinuity. Subroutines available in computer libraries can be used for the computations. The analysis shows that the point of instability is related to marginal stability or overstability. Simulations concerning nonlinear stability analysis may reveal how overstable motions enhance the intensity of convection currents in the aquifer. Such simulations can also be helpful for the interpretation of field measurements of piezometric head, temperature and salinity profiles in an aquifer subject to thermohaline convection. The nonhomogeneity of the aquifer modifies the symmetrical shape of the covection cell. Larger flow velocities as well as temperature and salinity gradients exist in the less resistant regions of the saturated porous formation. (Baker-FRC)
W83-02675

WELL HYDRAULICS IN VERTICALLY HETEROGENEOUS FORMATIONS,
Exxon Production Research Co., Houston, TX.
T. D. Streltsova.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1311-1327, November, 1982. 11 Fig, 43 Ref.

Descriptors: *Hydraulics, *Wells, *Aquifer characteristics, Drawdown, Groundwater, Aquifers, Permeability, Infiltration, Water storage.

Comparative analysis of time-dependent drawdown alterations caused by the heterogeneous properties of stratified formations is given based on the solutions developed under different assumptions on interlayered crossflow. The assumption of proportionality of leakage to the differential flow depletion, which is widely used in leaky aquifers developments, severely modifies the calculated drawdown values for both the aquifer and the aquitard as compared to those values obtained by assuming the diffusivity distribution process for the flow within each layer. The drawdown pattern is particularly affected at the early times. It is shown that if the compressibility of the low permeability layer is taken into account, the shape of transient drawdown curves is a function not only of the ration of permeabilities of the permeable and the semipermeable layers but of the ratio of their storages as well. (Author's abstract)
W83-02693

VALLES CALDERA GEOTHERMAL SYSTEMS, NEW MEXICO, U.S.A.,
Los Alamos Scientific Lab., NM.
F. Goff, and C. O. Grigsby.
Journal of Hydrology, Vol 56, No 1/2, p 119-136, March, 1982. 6 Fig, 3 Tab, 38 Ref.

Descriptors: *Geothermal resources, *Exploration, *Energy sources, *Geohydrology, Valles Caldera, *New Mexico, Volcanoes, Drilling, Hot dry rock systems, Thermal water, Saline water, Deep wells, Wells, Powerplants, Electric powerplants, Hydrothermal studies.

Valles Caldera is part of a Quaternary silicic volcano in northern New Mexico that posesses enormous geothermal potential. The caldera has formed at the intersection of the volcanically active Jemez lineament and the tectonically active Rio Grande rift. Volcanic rocks of the Jemez Mountains overlie Paleozoic-Mesozoic sediments and Precambrian granitic basement. Although the regional heat flow along the Rio Grande rift is about 2.7 HFU (1 heat flow unit = 1 microcal/sec/sq cm), convective heat flow within the caldera exceeds 10 HFU. A moderately saline hot-water geothermal system (T greater than 260 deg C, Cl = 3000 mg/liter) has been tapped in fractured caldera-fill ignimbrites at depths of 1800 m. Surface geothermal phenomena include central fumaroles and hot acid springs surrounded by dilute thermal meteoric hot springs. Derivative hot springs from the deep geothermal reservoir issue along the Jemez fault zone 10 km southwest of the caldera. Present geothermal projects are: (1) proposed construction of an initial 50-MW power plant using known geothermal reservoirs, (2) research and development of the prototype hot dry rock geothermal system that circulates surface water through deep Precambrian basement (about 5 MW); (3) exploration for deep hot fluids in adjacent basin-filled sediments of the Rio Grande rift; and (4) shallow exploration drilling for hot fluids along the Jemez fault zone. (Author's abstract)
W83-02701

GROUND-WATER RECHARGE RATES IN MINNESOTA AS RELATED TO PRECIPITATION,
Minnesota Geological Survey, St. Paul.
R. Kanivetsky, and B. Palen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191858, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center Completion Report, Univ. of Minnesota, St. Paul, March 1983. 37 p, 43 Ref. OWRT B-153-Minn(1), 14-34-0001-0268.

Descriptors: *Evaporation, *Groundwater recharge, Hydrogeology, Recharge, Permeability, Precipitation, *Storage coefficient, Stream discharge, *Minnesota, *Groundwater level fluctuations.

Quantitative estimates of recharge rates and storage coefficients in sufficient detail are essential to any meaningful state water-resources management, policies, plans and legislation. A methodology was developed to derive quantitative estimates of ground-water recharge rates and storage coefficients for unconfined aquifers in the various hydrologic regions of Minnesota. Recharge estimates are based on information from ground-water hydrographs. Statistical analysis of ground-water level fluctuations and their correlation with precipitation, evaporation, stream discharge were evaluated. Harmonic analysis and autoregression analysis of water levels were done. Storage coefficients were estimated from pumping test data, soil moisture method and empirical equations. Groundwater recharge rates were determined by combining data on ground-water level fluctuations and storage coefficient evaluation for unconfined aquifers in Minnesota. This work is fundamental to the ultimate goal of an interactive water resources model of the state.
W83-02730

2G. Water In Soils

RHIZOS: A SIMULATION OF ROOT GROWTH AND SOIL PROCESSES. SENSITIVITY ANALYSIS AND VALIDATION FOR COTTON,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
B. Bar-Yosef, J. R. Lambert, and D. N. Baker.
Transactions of the ASAE, Vol 25, No 5, p 1268-1273, 1281, September/October, 1982. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Plant growth, *Computers, *Soil moisture, Water availability, Nutrients, Model studies, Uptake, Soil-water-plant relationships, Roots, *Cotton.

A sensitivity analysis of a computer simulation of two-dimensional root, water and nitrate distributions in the soil and uptake by the plants showed that the model is more sensitive to selected environmental parameters than to plant parameters. Among the latter, the effect of the time period during which a root unit is taking up water and nitrate at a maximum efficiency is the greatest. Among the environmental factors, the sensitivity of the model is greatest for variations in maximum and minimum daily temperature. To evaluate the model, simulated and experimental results of cotton root and water content distributions in the soil during the growth period were compared. The model can reasonably predict root and water distributions in the soil under various conditions normally prevailing in the field. (Baker-FRC)
W83-02456

ESTIMATION OF SOIL WATER PROPERTIES,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
W. J. Rawls, D. L. Brakensiek, and K. E. Saxton.
Transactions of the ASAE, Vol 25, No 5, p 1316-1320, 1328, September/October, 1982. 2 Fig, 3 Tab, 35 Ref.

Descriptors: *Soil properties, *Water availability, *Soil moisture, Data collections, Data acquisition, Water retention, Irrigation, Hydraulics, Fluid mechanics, Conductivity, Permeability, Infiltration.

Relationships of soil water tension and hydraulic conductivity with soil water content are needed to quantify plant available water and to model the movement of water and solutes in and through soils. Field and lab measurement of these hydraulic soil properties is difficult, laborious and costly. To provide the best estimates possible from previous analyses, a comprehensive search of the literature and data sources for hydraulic conductivity and related soil-water data was made in 1978. From this search, data for 1,323 soils with about 5,350 horizons from 32 states were assembled. From the data, the Brooks and Corey water retention parameters, soil water retention volumes at 0.33 bar and 15 bar, total porosity, and saturated conductivities for the major USDA soil texture classes were developed. Also, relationships for predicting water retention volumes for particular tensions and saturated hydraulic conductivities based on soil properties are presented. (Baker-FRC)
W83-02459

INVESTIGATIONS OF SOLUBLE SALT LOADS, CONTROLLING MINERALOGY, AND FACTORS AFFECTING THE RATES AND AMOUNTS OF LEACHED SALTS,
Montana Coll. of Mineral Science and Technology, Butte.
For primary bibliographic entry see Field 2K.
W83-02497

EFFECT OF SUBTERRANEAN DRAINAGE ON SOME PROPERTIES OF CLAY SOILS IN QUEBEC (EFFET DU DRAINAGE SOUTERRAIN SUR QUELQUES PROPRIETES DE SOLS ARGILEUX DU QUEBEC),
Department of Agriculture, Quebec. Research Station.
C. R. De Kimpe, and M. R. Laverdiere.
Canadian Journal of Soil Science, Vol 60, No 1, p 83-96, February, 1980. 4 Fig, 3 Tab, 17 Ref.

Descriptors: *Soil properties, *Drainage, *Farming, Agriculture, Rainfall-runoff relationships, Rainfall, Chemical properties, Soil chemistry, Physical properties, Manganese, Minerals, Soil management, Land management, Management, *Quebec.

To study the effect of long-term internal drainage on the physical and chemical properties of soils, four series of agricultural soils of Quebec were sampled in the Lowlands on drained and undrained sites. Change in structure was noted in the Ste-Rosalie soils. A massive layer was noted below 18 cm in the undrained profile to have been replaced by a more structured layer at greater depth in the drained profiles. Occurences of mottles down to the Cg horizon reflected the better aeration conditions in the drained sites. Saturated hydraulic conductivity values were sometimes higher and sometimes lower than those measured in the undrained profiles. Below the plow layer, the two profiles drained for more than 50 years had a cation exchange capacity 12-15% higher than the undrained profiles. Oxalate-extractable iron represented a high percentage of the dithionite-extractable iron and indicated a low rate of formation of crystalline pedogenic oxides. Manganese accumulations were in the more compact layers. The improvement of internal drainage required a soil management what would enhance soil structure. (Baker-FRC)
W83-02613

USE OF SIMILARITY SOLUTIONS FOR THE PROBLEM OF A WETTING FRONT - A QUESTION OF UNIQUE REPRESENTATION,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano.
Advances in Water Resources Vol 5, No 3, p 156-166, September, 1982. 30 Ref.

Descriptors: *Mathematical equations, *Wetting, *Infiltration, Soil moisture, Moisture profiles, Porosity, Soil porosity, Darcys Law.

The use of similarity solutions for the problem of horizontal infiltration of water into a semi-infinite, dry and homogeneous porous medium is studied based on some recent results of functional analysis. While the general classification of similarity solutions into two kinds by Barenblatt and Zel'dovich has been a useful guide for practical applications, no easy method has been found for exactly determining each kind, and definite classification must rely upon rigorous mathematical analysis case by case. It is concluded that the so-called non-unique representation of reported experimental moisture profiles for this problem is not necessarily evidence against the validity of the extended Darcy's law for unsaturated flow through porous media. (Baker-FRC)
W83-02638

NODAL DOMAIN INTEGRATION MODEL OF ONE-DIMENSIONAL ADVECTION-DIFFUSION,
California Univ., Irvine. Dept. of Civil Engineering.
T. V. Hromadka, and G. L. Guymon.
Advances in Water Resources, Vol 5, No 1, p 9-16, March, 1982. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Model studies, *Mathematical studies, *Mathematical models, *Advection, *Solutes, Mathematical equations, Mathematical analysis, *Soil-moisture transport.

The nodal domain integration method was applied to a one-dimensional advection-diffusion mathematical model without a source term. The advection-diffusion equation was analyzed to determine an appropriate element matrix modeling statement which incorporates the finite element, finite difference, and subdomain integration modeling approaches. Also, a higher order spatial trial function approximation between nodal points was modeled by a linear trial function approximation in a diffusion dominated process. The linear approximation effort was based on determining a higher order trial function using information on the spatial distribution of the time derivative of the state variable. A case study is presented on a Fickian dispersion process of a conservative dissolved species with solute concentration C within pure water. (Small-FRC)
W83-02657

FIELD DETERMINATION OF INFILTRATION PARAMETERS (BESTIMMUNG VON INFILTRATIONSPARAMETERN MIT HILFE VON FELDMESSUNGEN),
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
S. H. Al-Azawi, and G. W. Marotz.

Wasserwirtschaft, Vol 72, No 7/8, p 290-292, July/August, 1982. 5 Fig, 12 Ref. English summary.

Descriptors: *Mathematical equations, *Infiltration, Soil water, Capillary, Hydraulic permeability, Conductivity, Irrigation programs, Irrigation, Permeability coefficient, Capillary conductivity.

A simple graphical solution of the one-dimensional infiltration equation based on field data has been developed. Since the saturated hydraulic conductivity and the average capillary suction are the most important parameters governing the infiltration, this method serves to determine these two parameters. The unsaturated hydraulic conductivity can also be determined from these parameters and from the moisture retention function. A comparison between the results of infiltration parameters and computed values shows good agreement. This technique has wide applicability in practical problems of irrigation. (Baker-FRC)
W83-02785

2H. Lakes

PHYSICO-CHEMICAL STUDY OF DEAD SEA WATER, II. DENSITY MEASUREMENTS AND EQUATION OF STATE OF DEAD SEA WATER AT 1 ATM,
Israel Oceanographic and Limnological Research Ltd., Haifa. Chemistry Dept.
B. S. Krumgalz, and F. J. Millero.
Marine Chemistry, Vol 11, No 5, p 477-492, 1982. 3 Fig, 7 Tab, 36 Ref.

Descriptors: *Density, Physical properties, *Saline lakes, *Dead Sea, Lakes, Mixing, Electrolytes, *Salts, Ions, *Israel.

The densities of artificial solutions of Dead Sea waters were measured at 20, 25, 30, 35, and 40C using a vibrating tube densimeter. A series of 25 solutions were prepared from NaCl, KCl, MgCl2, and CaCl2 to reflect the various compositions of the water from concentrations of 246.6634 to 271.3525 g salts per 1000 g solution. Dead Sea waters are dominated by Mg(++) and chloride. Densities, which varied from 1.199027 to 1.232747 g per ml, were very sensitive to changes in ionic composition. An equation of state for Dead Sea waters was determined. Average deviation between observed and calculated values was 0.000020 g per ml. A thermal expansion coefficient and coefficients characterizing the influence of the changes in salt or ionic concentrations on density were calculated. Partial molal volumes of Na, K, Mg, and Ca chlorides were calculated for 20, 30, and 40C. The changes in partial molal volumes of NaCl, and CaCl2 with temperature were positive, and that of MgCl2, less than zero. These data are important in understanding the possible effects of the proposed canal which would bring Mediterranean Sea water into this lake. (Cassar-FRC)
W83-02464

TURBIDITY AND ITS CAUSES IN A NARROW GLACIAL LAKE WITH WINTER ICE COVER,
State Univ. of New York at Buffalo. Dept. of Biology.
K. M. Stewart, and P. J. H. Martin.
Limnology and Oceanography, Vol 27, No 3, p 510-517, May, 1982. 12 Fig, 23 Ref.

Descriptors: *Turbidity, *Seasonal variation, *Glacial lakes, *Mixing, Lakes, Coriolis force, Stratification, Destratfication, Density, Suspended solids, *New York, Hemlock Lake.

A field study was conducted of the seasonal variations in turbidity in Hemlock Lake, a narrow glacial Finger Lake south of Rochester, New York. In the summer and under winter ice cover, the turbidity structure is primarily vertical. During spring and fall mixing periods, horizontal gradients in turbidity predominate. At the southern end of the lake, inflows from the large drainage area show a Coriolis effect, with good correlations between vertical mixing and density. Turbidity seems to be associated principally with suspended inorganic matter throughout most of the year. (Geiger-FRC)
W83-02470

QUANTIFICATION OF MECHANISMS RESPONSIBLE FOR BLUEGREEN ALGAL DOMINANCE,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
D. L. King, J. M. Repko, and C. N. Spencer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190470. Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State Univ., East Lansing, February, 1983. 30 p, 10 Fig, 3 Tab, 42 Ref. OWRT A-115-MICH(1), 14-34-0001-1124.

Descriptors: *Light intensity, *Photosynthesis, *Carbon dioxide, *Carbon fixation, Nitrogen fixation, Algae, Sinking rate, Chorella vulgaris, Anacystis nidulans, Anabaenopsis elenkinii, Ammonia, *Michigan, *Cyanophyta, Chlorophyta, Water pollution control, Vacuolate buoyancy.

Light intensity and carbon dioxide concentration interact in a multiplicative manner to control both threshold conditions required to initiate net photosynthetic carbon fixation and the specific rate of carbon fixation by the small, non-vacuolate, bluegreen algae Anacystis nidulans. The average sinking rate of the small green alga Chorella vulgaris is constant at a rate of 0.45 cm/hr and is not altered by variation in light intensity, carbon dioxide concentration, or the presence or absence of bacteria. Buoyancy of the vacuolate, nitrogen fixing bluegreen alga Anabaenopsis elenkinii is determined by an interaction between light intensity, carbon dioxide concentration and the ammonia content of the water.
W83-02482

EFFECT OF SORPTION ON MINERALIZATION OF LOW CONCENTRATIONS OF AROMATIC COMPOUNDS IN LAKE WATER SAMPLES,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
R. V. Subba-Rao, and M. Alexander.
Applied and Environmental Microbiology, Vol 44, No 3, p 659-668, September, 1982. 5 Fig, 4 Tab, 22 Ref.

Descriptors: *Organic compounds, *Lake water, *Mineralization, Montmorillonite, Benzylamine, Kaolinite, *Aromatic compounds, Eutrophic lakes, Chemical reactions, Biodegradation, *Clays.

The influence of montmorillonite, kaolinite, and glass microbeads on the mineralization of low concentrations of organic compounds in samples from a eutrophic lake was examined. Montmorillonite/benzylamine complexes were formed immediately on addition of amine to suspensions containing the clay. The extent of amine sorbed was a linear function of equilibrium amine concentration in lake water. A larger percentage of the chemical was released from the complex during mineralization in the presence of high clay concentrations than in the presence of low clay concentrations. Montmorillonite did not enhance mineralization rates at amine levels of 200 ng/ml or lower, but it was stimulatory at 20 micrograms/ml. Except at high amine and clay concentrations, mineralization was more rapid than desorption during the early periods of decomposition when the amine concentration in solution was relatively high. Relative to the microbial demand, desorption was more rapid during later periods of decompositon when the amine level in solution was very low. Mineralization of benzoate was not usually affected by montmorillonite, kaolinite, or glass beads. More than 90% of the carbon from benzylamine and benzoate was often mineralized when the substrate concentration was 250 ng/ml or less. The data suggest that clay may have a significant effect on the microbial decomposition of low concentrations of certain organic compounds. (Baker-FRC)
W83-02554

COMPARATIVE SEASONAL UPTAKE OF GLUCOSE AND ACETATE BY EPIPHYTIC BACTERIA ON THE SURFACES OF THREE SPECIES OF MACROPHYTE IN THE LITTORAL ZONE OF LAKE OHRID, YUGOSLAVIA,
Toledo Univ., OH. Dept. of Biology.
H. L. Allen, and B. T. Ocevski.
Archiv fur Hydrobiologie, Vol 93, No 4, p 423-445, March, 1982. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Bacteria, *Epiphytes, *Organic carbon, Lakes, Lake Ohrid, *Yugoslavia, Macrophytes, Aquatic plants, Nutrients, Seasonal variation, Glucose, Acetate, Littoral zone, Kinetics, Turnover time, Enzymes, Metabolism, Adsorption.

Uptake of C14-labeled glucose and acetate by epiphytic bacteria on the surfaces of 3 macrophytes in Lake Ohrid, Yugoslavia, was measured on several occasions from June 1978 to June 1979. Uptake kinetics indicated first-order, ennzyme mediated, active transport. The mean seasonal maximum theoretical glucose uptake velocities at 0.5 m below the surface were 6.38, 22.63, and 4.38 micrograms per liter per hour per sq dm of macrophyte surface area for Phragmites, Potamogeton, and Nuphar, respectively. Acetate removals by epiphytes on the same macrophytes were 10.65, 57.00, and 18.63 micrograms per liter per hour per sq dm, repectively. The mean seasonal maximum theoretical velocities of glucose incorporation, extrapolated to the mean surface area available for colonization per sq m of littoral zone (uncorrected for respiratory losses during in situ incubations) were 15.92, 17.71, and 0.69 mg C per sq m per day at Phragmites, Potamogeton, and Nuphar sites, respectively. Corresponding acetate removals were 10.62, 44.01, and 2.22 mg C per sq m per day. Turnover times for glucose and acetate removals averaged 2.0-5.2 hours during summer thermal stratification and 5.3-132 hours during the rest of the year. Turnover times were inversely correlated with estimated maximum theoretical uptake velocities. Approximations of maximum ambient substrate concentrations of glucose and acetate physiologically available to epiphyte bacteria were 1.8-76 micrograms per liter and 0.4-379 micrograms per liter, respectively. The natural concentrations of both substrates occasionally approached zero availability. (Cassar-FRC)
W83-02556

LAKE FIDLER, A MEROMICTIC LAKE IN TASMANIA,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
R. D. King, and P. A. Tyler.
Archiv fur Hydrobiologie, Vol 93, No 4, p 393-422, March, 1982. 28 Fig, 1 Tab, 45 Ref.

Descriptors: *Meromictic lakes. *Chemocline, *Seasonal variation, Environmental effects, Lake Fidler, Gordon River, *Tasmania, Holomictic lakes, Anaerobic conditions, Sulfides, Bacteria, Dam effects, Lakes, Shallow water, Saline water intrusion, Monimolimnion, Chemical properties, Physicochemical properties, Water temperature, Stratification, Chlorophyll a, Light penetration, Dissolved oxygen, Oxygen, Conductivity.

Lake Fidler, one of several meromictic shallow, riverine lakes on the Gordon River, Tasmania, may revert to a holomictic state as a result of the October 1977 completion of a power station downstream. The meromictic state has been maintained by intrusion of an estuarine salt wedge, which no longer penetrates as far as the lake area. Water sampling from January 1977 to April 1978 was conducted to define the physicochemical properties of the lake water. Temperature profiles included normal stratification in December-March, inverse stratification in July and August, dichothermy in July and October, and more complex profiles on occasion. A chemocline occurred at 2.2 m. The monimolimnion was always anoxic. Sulfides in this layer increased in midsummer. At the redoxycline/oxycline a narrow stratified plate of flagellates and photoautotrophic bacteria was found. The population density was greatest in summer and lowest in winter. The color produced by the abundant humic materials attenuated the photosynthetically active radiance (PAR). Attenuation coefficients of downwelling PAR were 1.11-1.62 per m. Wavelengths below 560 nm were extinguished in the upper half meter, and very little light was present (all above 640 nm). Fidler Lake showed no signs of becoming holomictic 5 months

after the flow regulation began. However, gilvin values declined as a result of increased flows. Loss of meromictic qualities is expected to occur gradually over many years from errosion of the chemocline and wind-induced turbulence. (Cassar-FRC)
W83-02557

THE SEASONAL VARIATION OF ORGANIC CONSTITUENTS IN A EUTROPHIC LAKE, LAKE SUWA, JAPAN. PART 1, PARTICULATE ORGANIC MATTER,
Nagoya Univ. (Japan). Water Research Inst.
For primary bibliographic entry see Field 5C.
W83-02559

TRANSPORT AND FATE OF HEAVY METALS IN ONONDAGA LAKE, NEW YORK,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W83-02562

ACID PRECIPITATION AND LAKE SUSCEPTIBILITY IN THE CENTRAL WASHINGTON CASCADES,
Central Washington Univ., Ellensburg. Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W83-02566

KINETIC FRACTIONATION OF CARBON-13 DURING CALCIUM CARBONATE PRECIPITATION,
Commonwealth Scientific and Industrial Research Organization, Floreat Park (Australia). Div. of Land Resources Management.
For primary bibliographic entry see Field 2K.
W83-02570

STRUCTURE AND FUNCTION OF A CYANOPHYTAN MAT COMMUNITY IN AN ACIDIFIED LAKE,
Lund Univ. (Sweden). Limnological Inst.
S. Lazarek.
Canadian Journal of Botany, Vol 60, No 11, p 2235-2240, 1982. 1 Fig, 3 Tab, 27 Ref.

Descriptors: *Oligotrophic lakes, *Cyanophyta, *Acidic water, *Benthic environment, *Hydrobiology, *Primary productivity, Lakes, Algae, Benthic flora, Benthic fauna, Midges, Diatoms, Photosynthesis, *Sweden, Lake Gardsjon.

The structural and functional properties of a cyanophytan mat community of the acidified, extremely oligotrophic lake, Lake Gardsjon of Southwest Sweden, were studied. Results showed that the blue-green algal mat forms a perennial cohesive blanket-like cover over the organic matter-rich sediment and is well adapted to the acid conditions of the lake. The surface of the mat shows an undisturbed reticular structure with an uppermost stratum (2-3 millimeters) of dense motile filaments of Lyngbya bourrellyana Compere, and to a lesser extent, Oscillatoria geminata Meneghini. Other benthic organisms and pennate diatoms are also abundant within the filamentous matrix. Chironomids reside in the surface of the mat, while the lower strata are occupied by nematodes. Relatively high rates of algal primary productivity and low rates of nitrogen fixation were recorded in the mat. Light is a principal factor limiting benthic algal photosynthesis. (Geiger-FRC)
W83-02610

THE EFFECTS OF LIMNOLOGICAL PROCESSES ON THE QUALITY OF IMPOUNDED WATERS (AUSWIKUNGEN LIMNOLOGISCHER VORGANGE AUF DIE BESCHAFFENHEIT VON STAUGEWASSERN),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
H. Bernhardt.
Wasserwirtschaft, Vol 71, No 4, p 110-111, April, 1981. 2 Fig, 1 Tab. (No English Summary).

Descriptors: *Limnology, *Reservoirs, *Water quality, *Water circulation, *Water pollution, Seasonal variation, Radiation, Wind, Lake morphology, Lake classification, Water use, Eutrophication, Phosphorus, Organic compounds, Trace elements, Nutrients, Fertilizers, Nitrogen.

Water quality is significantly altered when running water is impounded and its flow speed is reduced to 100 mm/sec or less. Radiation energy and wind exert a great influence on water > 6-8-m deep by creating a temperature-dependent stratification during summer and fall, whereby water circulation is inhibited or interrupted (stagnation). In winter and spring, circulation may be interrupted through surface-water cooling to temperatures < 4C or by ice cover. Seasonal variation with depth consequently occurs differently in concentrations of oxygen; carbon dioxide; iron, manganese, ammonium, nitrate, and sulfate ions; and dissolved organic compounds. If water retention time in the lake is > 10 days, algae and macrophytes can develop -- particularly in the mouths of feeder streams. The intensification of primary production in the lake, which is related to this phenomenon and is caused by overfertilization with nutrients, is designated as eutrophication. Phosphorus is usually the chief cause of this, at least in lakes in the Federal Republic of Germany. The Lake's morphological characteristics also play a role in bioproduction: lakes with an average depth of < 18-20 m with long shallow bays in wind-sheltered situations have short circulation periods and are therefore susceptible to eutrophication. Cultivated land above lakes can exert a negative influence on water quality. A graph showing the probability that a given lake will be oligo-, meso-, or eutrophic according to the relationship between total phosphorus concentration and time is presented, as is a table showing uses possible for lakes of differing quality. (Gish-FRC)
W83-02784

2I. Water In Plants

RHIZOS: A SIMULATION OF ROOT GROWTH AND SOIL PROCESSES. SENSITIVITY ANALYSIS AND VALIDATION FOR COTTON,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
For primary bibliographic entry see Field 2G.
W83-02456

THE ADAPTATION OF VARIETIES OF SORGHUM TO DIFFERENT WATER REGIMES,
Institut National de Recherches Agronomiques au Niger, Niamey.
N. I. Jika, C. A. St. -Pierre, and J. C. Denis.
Canadian Journal of Plant Science, Vol 60, No 1, p 233-239, January, 1980. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Drought, *Sorghum, *Crop yield, Rainfall, *Plant growth, Grains.

The abilities of twelve varieties of sorghum to adapt to drought were measured on nine hybrids and three lines of various origin. Polyethylene covers were used to simulate drought conditions at five experimental locations during the 2 year study. The yield of grain was used to evaluate the stability of the plants at the sites. The hybrids demonstrated a wider adaptability than the lines used in the experiment. Correlation studies demonstrated that any relationship between yield and physiological characteristics was at best low and usually insignificant. (Baker-FRC)
W83-02612

PLANT-SUBSTRATE INTERACTIONS AND BELOW SUBSTRATE BIOMAS DYNAMICS: A CONTINUATION OF STUDIES CONCERNING POTENTIAL RESTRICTION OF THE INTRODUCED AQUATIC WEED MYRIOPHYLLUM , SPICATUM L. (EURASIAN WATER MILFOIL),
Tennessee Univ., Knoxville. Dept. of Ecology.
C. C. Amundsen, and A. L. Brenkert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191841, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center Research Report No 92, Univ. of Tennessee, Knoxville, April 1982. 69 p, 11 Fig, 28 Tab, 62 Ref, 1 Append. OWRT B-044-TENN(1), 14-34-0001-9097.

Descriptors: *Aquatic weeds, Reservoirs, *Weed control, *Myriophyllum, *Substrates, Biomass, Weeds, Water temperature, *Potassium, *Nitrogen compounds, Light penetration, Wave action, Melton Hill Reservoir, Eurasian water milfoil, Clinch River, *Tennessee, Sediments.

From the study's data analysis, it was concluded that the prediction of nuisance growth of Eurasian watermilfoil depends not only on sediment phosophorus, nitrate-nitrogen and ammonia -nitrogen, but potassium levels as well. Higher water temperatures together with non-exposure to wave action and water stream flow, likely accounts for the development of the larger standing crop of Eurasian water milfoil within the study of the Melton Hill (TN) Reservoir. Myriophyllum spicatum L. was collected monthly from five study sites. Whole plant samples were collected from similar bottom contour plots via SCUBA. Sediment samples were collected using a Ponar Grab, and water solumn measurements were taken with a YSI temperature and conductivity meter. Sediment samples were air dried and sieved. Organic matter, available phosophorus, potassium and sediment pH, and sediment nitrate were determined. Sediment texture was determined gravimetrically. Plant material was partitioned into above sediment plant material, rhizomes and roots, rinsed, dried and ground. Over-dry weight, starch and ash content were determined for all potassium content. The sulfuric acid-Hydrogen peroxide technique was used to determine the tissue nutrient content and colorimetric determination of ammonium-nitrogen levels were determined by Nesslerization. Phosophorus levels via Molybdenum Blue Method and Potassium levels by Atomic Absorption Spectrophotometer. Logarithmic transformations were performed on all data prior to statistical analysis to correct for variance heterogeneity.
W83-02729

RELEASE OF FE, MN AND P IN A CALCAREOUS VERTISOL AND YIELD OF UPLAND RICE AS INFLUENCED BY PRESOWING SOIL WATER TREATMENTS,
Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Dept. of Agricultural, Chemical and Soil Science.
K. R. Sonar, and R. V. Ghugare.
Plant and Soil, Vol 68, No 1, p 11-18, 1982. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Rice, *Irrigation, *Nutrients, Vertisols, Iron, Manganese, Phosphorus, Crop yield, Soil water, Chemical composition.

In an effort to increase availability of Fe, Mn, and P to upland rice crops grown in high-pH vertisols, three pre-sowing soil water treatments were compared. The three 15-day treatments were: (1) control, no irrigation, (2) field capacity (5 cm irrigation on alternate days), and (3) saturation (2 irrigations daily). At sowing time the saturated treatment increased available soil Fe from 2.89 to 4.83 ppm. Similarly the available Mn concentration was increased from about 5 to about 8.5 ppm. Increases in available P were less dramatic, from 10 to 13 ppm. As the growing season progressed, differences in available nutrient levels between control and treated plots decreased. Laboratory studies showed the following soil properties: control--8.6 pH, +501 mv Eh, 3.73 ppm Fe, 6.91 ppm Mn, and 8.96 ppm P; 15-day field capacity, 8.3 pH, 455 mv Eh, 5.51 ppm Fe, 7.98 ppm Mn, 9.77 ppm P; 15-day soil saturation, 7.9 pH, 395 mv Eh, 6.49 ppm Fe, 13.72 ppm Mn, 10,18 ppm P; 15-day submergence, 7.5 pH, 362 mv Eh, 10.49 ppm Fe, 39.61 ppm Mn, and 13.89 ppm P. The Tuljapur 1 cultivar yielded more than Karjat 184 under upland conditions. (Cassar-FRC)
W83-02797

2J. Erosion and Sedimentation

MODERN SEDIMENT ACCUMULATION AND STRATA FORMATION ON THE AMAZON CONTINENTAL SHELF,

North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
For primary bibliographic entry see Field 2L.
W83-02463

SIGNIFICANCE OF RIVER FLOW FOR THE SUSPENDED SOLIDS BURDEN AND ITS RETENTION IN THE IMPOUNDED RUHR (BEDEUTUNG DES ABFLUSSES FUR DIE SCHWEBSTOFFFRACHT UND IHRE RETENTION IN DER GESTAUTEN RUHR),
Ruhrverband, Essen (Germany, F.R.). Chemisches und Biologisches Lab.
P. Klopp, and K. -H. Kornatzki.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 10, p 467-472, October, 1981. 9 Fig, 5 Tab, 15 Ref.

Descriptors: *River flow, *Suspended solids, *Reservoirs, Runoff, Sedimentation, Lakes, Morphology, Metals, Iron, Lead, Zinc, Nickel, Lake sediments, *Federal Republic of Germany, Ruhr impoundments.

The relationship between river flow and the load of suspended solids and its retention was investigated by frequent random sampling at the inflow and effluent of the Ruhr impoundment at Baldeney. Both relationships, load versus runoff and variation of load versus runoff, indicate a progressive increase at flows above 200 cubic meters/second. The morphology of the impounded lake allows maximum retention rates of about 50%. About half of the annual amount of suspended solids retained in the lake settles on only 20 days when the runoff exceeds 200 cubic meters/second. Sedimentation rates for the heavy metals iron, lead, zinc and nickel correspond with analytical data of the lake sediment, and thereby confirm the method of balance used here, which is based on a large number of random samples. (Author's abstract)
W83-02587

DEPOSITION OF SEDIMENTS ON THICKET-COVERED FLOOD PLAIN,
Yu. N. Sokolov.
Hydrotechnical Construction, No 11, p 1135-1139, November, 1980. 3 Fig, 6 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 11, p 21-23, November, 1980.

Descriptors: *Flood plains, *Deposition, *Vegetation effects, Sand, Rivers, Sediment transport, Sediment distribution, *USSR, Podcherem River, Mana River.

Flood plain sand deposits are classified as general (small thickness, widely and uniformly spread) or local (meso- or microdeposits). Local deposits are affected by relief and vegetation. In flood plains of the Podcherem and Mana Rivers, which do not have sand fractions in the flow, no accumulations of sediment deposits were observed in places where vegetation was concentrated. Local sediment deposits downstream from different types of vegetation were studied at a bend of the Oka River flood plain near Beloomut, USSR, after a 50% frequency flood in the summer of 1978. For equal flow velocities and saturation of flow with sediments, the volume of deposits as a function of the generalized vegetation parameter varied from 0.005 cu m for a low shrub to 0.85 cu m for a shrub with a large center and weak permeability. The vegetation parameter considered the plant diameter, degree of vertical continuity, plant height and the water depth in the flood plain. Data from the rivers were used to construct graphs of sediment deposit volume and vegetative thickness. The Mologa River had a curve entirely different from those of the Ilet and Kolp Rivers. (Cassar-FRC)
W83-02605

CASE HISTORY OF SEDIMENTATION AT PELIGRE DAM, HAITI (CAS HISTORIQUE DE SEDIMENTATION DU BARRAGE PELIGRE, HAITI),
Laval Univ., Quebec. Dept. of Civil Engineering.
M. Frenette, J. P. Tournier, and T. J. Nzakimuena.
Canadian Journal of Civil Engineering, Vol 9, No 2, p 206-223, June, 1982. 20 Fig, 4 Tab, 5 Ref.

Descriptors: *Sedimentation, *Reservoirs, Design criteria, *Silting, Erosion, Predicting, Mathematical equations, Simulation, Watershed, *Haiti, Peligre Dam, Artibonite River.

The Peligre Dam in Haiti on the Artibonite River was built in 1956 with an expected life of about 180 years. Based on sedimentation data collected in 1925 and 1926, the average rate of silting in the reservoir was estimated at 345,000 cubic meters/year. In 1979, however, an average sedimentation rate of 9,600,000 cubic meters/year was established. Systematic studies were undertaken to explain the phenomenon and predict future silting rates. The studies led to simulation, by means of a mathematical model, of the processes involved and have permitted reconstruction of the hydro-sedimentological events since 1956 as well as prediciton of the future rate of sedimentation. The main physical processes responsible for the patterns of deposition were used as common denominators: degradation of watershed and rivers, effects of deforestation, urbanization, and agriculture, effects of flocculation and consolidation, effect of the reservoir geometry, expected sediment inflow, water inflow versus outflow, and others. The model indicates very well the acceleration of the silting rate, with an average increase of about 18% per year. The study shows that the sediment inflow took the form of a quadratic or exponential growth curve. After 23 years the average silting is three times that of the design. Greater care must be taken in predicting long-term sedimentation rates in a reservoir, since the lifetime of the dam may be appreciably reduced. (Baker-FRC)
W83-02611

ESTIMATION OF THE SIZE AND ROUGHNESS OF SEDIMENTS IN HYDRAULIC CALCULATIONS,
For primary bibliographic entry see Field 8B.
W83-02622

FLUVIAL HYDRAULICS OF DELTAS AND ALLUVIAL FANS,
San Diego State Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W83-02678

SALTATION IN WATER DYNAMICS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W83-02679

CELERITY OF TRANSIENT BED PROFILES,
San Diego State Univ., CA. Dept. of Civil Engineering.
V. M. Ponce.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1393-1397, November, 1982. 2 Fig, 6 Ref.

Descriptors: *Alluvial channels, *Mathematical equations, *Bed load, Sediment transport, Hydraulics, Channels.

Linear stability analysis was performed on the set of equations governing the flow of water and sediment in alluvial channels, assuming flows well below the critical state. The equation was reduced, assuming large values of the dimensionless wave number. The applicability of the formula obtained for the calculation of celerity of alluvial channel bed transients has been verified using data from flume experiments. The formula is easy to use; the results obtained are encouraging and show the promise of this approach in the qualitative analysis of unsteady alluvial channel hydraulics. (Baker-FRC)
W83-02694

RELATIONSHIPS BETWEEN MORPHOLOGY OF SMALL STREAMS AND SEDIMENT YIELD,
H. H. Chang, W. L. Graf, E. H. Grissinger, H. P. Guy, and W. R. Osterkamp.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1328-1365, November, 1982. 11 Tab, 181 Ref.

Descriptors: *Streams, *Morphology, *Sediment transport, Erosion, Erosion control, Model studies, Mathematical equations, Vegetation, Banks, Flow, Hydraulics, Hydrodynamics, Channels, Canals, Design criteria.

The state of the art in the relations between morphology of small streams and sediment yield is assessed. Research findings and recommendations for additional research are presented. Topics include systems and interactions, simulation models, channel forms and processes, transport of sediment in small streams, and aspects of channel morphology. Simulation models for erosion and sediment yield were reviewed, and their role in providing estimates of the upland input of water and sediment of stream channels was noted. Many of the models include channel erosion and deposition. The presence of a free water surface in open channel flow adds an element of complexity in that depth of flow is free to change in response to changing conditions. Alluvial bed forms and their relation to hdraulic resistance, and, thus, depth discharge formulas, were reviewed and found to differ depending on flow conditions. Self-forming streams in the downstream direction can be patterned as straight, meandering or braided. The patterns and associated temporal and spatial interactions are again seen as complex inasmuch as channel form can affect the gradient and countercurrents and thus channel geometry and sediment transport capacity. Sediment-transport formulas, the form and structure of stream channels, and regime theory developed from the need for design criteria for sediment carrying canals were reviewed. Calibration of hydraulic geometry equations for natural streams, the synthesis of the erosion and sediment transport methods, the effects of geologic materials, and the influence of bank vegetation on channel erosion and sedimentation were also considered. (Baker-FRC)
W83-02697

BED CHARACTERISTICS IN ALLUVIAL CHANNEL BENDS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
A. J. Odgaard.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1268-1281, November, 1982. 8 Fig, 28 Ref.

Descriptors: *Erosion control, *Alluvial channels, Sacramento River, *River beds, Sediments, Sedimentation, Erosion, Slope, Channels, Froude number, *California.

A new approach is presented to the description of the steady-state flow and bed characteristics in an alluvial channel bend. The approach is based on a combination of the principal of moment-of-momentum flux and a critical-shear-stress analysis. The approach is used to explain observed transverse variations of depth, depth-averaged velocity, and mean grain size in a bend of the Sacramento River, California. The local transverse bed slope was found to vary linearly with the bed-surface particle Froude number. It is established that the distributions of depth, depth-averaged velocity, and bed surface sediment size depend on the variety of grain sizes in the bed sediment. Equations for the transverse variation of depth, depth-average velocity, and mean grain size are developed which can provide a guide to the depth of bed erosion and depth-averaged velocity near the outer banks of river bends. (Baker-FRC)
W83-02698

SALTCEDAR INFLUENCE ON SEDIMENTATION IN THE BRAZOS RIVER,
Texas A and M Univ., College Station. Dept. of Range Science.
W. H. Blackburn, R. W. Knight, and J. L. Schuster.

Journal of Soil and Water Conservation, Vol 37, No 5, p 298-301, September/October, 1982. 4 Fig, 2 Tab, 9 Ref.

Descriptors: *Rivers, Streamflow, *Plant growth, *Sedimentation, Channels, Floods, Brazos River, *Saltcedar, *Texas.

Saltcedar infestations along thee Brazos River between Seymour, Texas and the river's confluence with the Clear Fork occupied 57% of the original river channel by 1979. As saltcedar established itself on sandbars and channel edges, the plants stabilized the channel sediments, causing deposition. By 1979, 3 meters of sediment had been deposited in the saltcedar-infested channel, and the river channel's width had been reduced by 89.6 meters. The presence of saltcedar and subsequent sediment deposition and channel closure in the Brazos River effectively reduced sedimentation of Possum Kingdom Lake. However, the saltcedar invasion resulted in higher flood stages for similar flow volumes, thus enlarging the area inundated by flood waters. This study thus reiterates the detrimental impact of saltcedar on stream dynamics and sedimentation. (Baker-FRC)
W83-02704

SEDIMENT DEPOSITION IN A FLOOD-RETENTION STRUCTURE AFTER TWO RECORD FLOODS IN SOUTHWESTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 4D.
W83-02705

LATERAL BED LOAD TRANSPORT ON SIDE SLOPES,
Saitama Univ. (Japan). Dept. of Foundation Engineering.
For primary bibliographic entry see Field 8B.
W83-02709

SEDCON: A MODEL OF NUTRIENT AND HEAVY METAL LOSSES IN SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
W. A. Gabbert, P. F. Ffolliott, and W. O. Rasmussen.
In: Hydrology and Water Resources in Arizona and the Southwest, Proceedings of the 1982 Meetings of the Arizona Section--American Water Resources Assoc., and the Hydrology Section--Arizona Academy of Science, Apr. 24, 1982, Vol 12, p 111-116. Ariz. Section, American Water Resources Assoc., Tempe. OWRT A-105-ARIZ(3), 14-34-0001-1103.

Descriptors: Water quality, *Nutrients, Hardness, *Mineral center, *Water resources management, *Watershed management, *Computer models, Model studies, *Heavy metals, Land management, *Sediment transport, Simulation analysis, Forest watersheds, SEDCON model, Southwest U.S.

A prototypical computer simulation model has been developed to aid watershed managers in estimating impacts of alternative land management practices on nutrient and heavy metal losses due to transported sediment on forested watersheds of the southwestern United States. The model, called SEDCON, allows users at remote locations with modest computer terminal equipment and commonly available data to obtain reliable estimates of nutrient and heavy metal concentrations in suspended sediment originating on uniformly-stocked, forested watersheds in the Southwest. SEDCON has been structured in an interactive mode to facilitate its use by persons not familiar with computer operations. Written in FORTRAN IV computer language, the model requires approximately 5000 words of core. SEDCON is operative on a DEC-10 computer at the University of Arizona.
W83-02734

2K. Chemical Processes

PHYSICO-CHEMICAL STUDY OF DEAD SEA WATER, II. DENSITY MEASUREMENTS AND EQUATION OF STATE OF DEAD SEA WATER AT 1 ATM,
Israel Oceanographic and Limnological Research Ltd., Haifa. Chemistry Dept.
For primary bibliographic entry see Field 2H.
W83-02464

TRANSPORT OF ION-EXCHANGING SOLUTES DURING GROUNDWATER RECHARGE,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W83-02478

FIELD EVIDENCE FOR SHALE MEMBRANE FILTRATION OF GROUNDWATER, SOUTH-CENTRAL MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W83-02483

INVESTIGATIONS OF SOLUBLE SALT LOADS, CONTROLLING MINERALOGY, AND FACTORS AFFECTING THE RATES AND AMOUNTS OF LEACHED SALTS,
Montana Coll. of Mineral Science and Technology, Butte.
J. J. Donovan, M. R. Miller, and J. L. Sonderegger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186502, Price codes: A05 in paper copy, A01 in microfiche. Montana Water Resources Research Center Report No 120, Montana State Univ., Bozeman, September 1981. 77 p, 19 Fig, 14 Tab, 32 Ref. OWRT A-112-MONT(1), 14-34-0001-9028, 14-34-0001-0128.

Descriptors: Geochemistry, *Saline water, *Salts, Mineralogy, Groundwater, *Ion transport, *Leaching, Cretaceous shale, Colorado group, Bearpaw formation, *Montana, Groundwater recharge, *Saline seeps, Groundwater pollution.

The quantity of soluble salts available for leaching beneath saline seep areas was assessed. The geochemical processes operating in saline groundwater systems were examined in a simulated weathering process by leaching at 55C and pH> 5.0 for 21 hours. Carbonate content and mineralogy of drill-hole samples was determined before leaching. The experimental leachates with calcium as the dominant cation were not similar to saline-seep waters discharges in the field dominated by Na+-Mg super 2+-SO sub 4 super 2 or Na+-SO sub 4 super 2- but were similar to waters from low-pH saline seeps in thin soils developed directly on Colorado Shale (Cretaceous), suggesting that the types of hydrolysis reactions observed in the laboratory occur in saline-seep systems in the unsaturated zone. Exchange reactions involving smectite also produce NA+ in leachate and field waters. Acidity not consumed by hydrolysis reactions is buffered by carbonates below the water table. New carbonates are formed in the vadose zone in the recharge area. Selenium occurs in a by-product of pyrite oxidation and dissolution and occurs in high concentrations in weathering of black shale or fresh shale-derived materials (till, colluvium). Its solubility may be controlled by organic ions as well as by inorganic phases. Aquifers in the Colorado Group and Bearpaw Formation in Montana are most susceptible to high selenium concentrations.
W83-02497

EFFECT OF SORPTION ON MINERALIZATION OF LOW CONCENTRATIONS OF AROMATIC COMPOUNDS IN LAKE WATER SAMPLES,
Cornell Univ., Ithaca, NY. Lab. of Soil Microbiology.
For primary bibliographic entry see Field 2H.
W83-02554

ACID PRECIPITATION AND LAKE SUSCEPTIBILITY IN THE CENTRAL WASHINGTON CASCADES,
Central Washington Univ., Ellensburg. Dept. of Chemistry.
R. M. Logan, J. C. Derby, and L. C. Duncan.
Environmental Science and Technology, Vol 16, No 11, p 771-775, November, 1982. 3 Fig, 2 Tab, 25 Ref.

Descriptors: *Acid rain, *Lakes, *Precipitation, *Washington, Cascade Mountains, Alpine lakes, Mountain lakes, Acidity, Alkalinity, Sulfates, Nitrates, Acidic water, Fate of pollutants, Air pollution, Water pollution sources, Chemical properties.

Precipitation samples were collected at five sites across the Cascade Mountains in the region of Snoqualmie Pass, 25-65 mi east and windward of Seattle, Washington, from January to July 1981. The volume weighted average pH was 4.71, with sulfate the dominant anion. The average strong acid compositions (sulfate and nitrate) at the five sites were 57 to 62 equivalent % sulfuric acid. Strong acid levels were higher in summer than in winter. Sulfate deposition for 1981 in this region was estimated to be 16.0 kg per ha per year, corrected for sea salt. This compares with 16.3 kg per ha per year sulfate depostion calculated from 1978 data. Therefore, the Mt. St. Helens emissions apparently bypassed these collection sites. Twenty-nine remote lakes in the Apline Lakes Wilderness Area 3-20 miles north of the precipitation collectors were sampled in summer of 1981. None were acid (pH 5.62-7.46, median 6.86). Alkalinities were low (4.0-190, median 57 microeq per liter). Specific conductances averaged 5.8 microS per cm. Two reservoirs had pH of 7.62 and 7.83, alkalinities of 246 and 346 micro eq per liter, and specific conductances of 3.95 and 38.5 micro S per cm. All lakes, though not at present acid, were classified as susceptible to acidification. (Cassar-FRC)
W83-02566

ACIDIFICATION OF AQUATIC SYSTEMS: A CRITIQUE OF CHEMICAL APPROACHES,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
J. Kramer, and A. Tessier.
Environmental Science and Technology, Vol 16, No 11, p 606A-615A, November, 1982. 4 Fig, 2 Tab, 44 Ref.

Descriptors: *Hydrogen ion concentration, *Alkalinity, *Acidity, Model studies, *Chemical analysis, Sample preservation, *Pollutant identification, Measuring instruments, Sulfates, Errors, Indicators, Methyl orange, Literature review.

This review examines the basic assumptions of chemical acidification models for aquatic systems and the reliability of historical data used to indicate long-term trends in acidification of water bodies. Acidification models are based on the electroneutrality condition and carbonic acid weathering. All major ions (Na, K, Ca, and Mg) should be considered. If a model is simplified using Ca as representative of all ions, comparisons can be made only within the same basin, providing that soil/lithological-water reactions are uniform throughout the basin. Oxidation-reduction protolyte reactions involving C, N, and S are not considered in any of the models examined. Reliance on historical data must be modified in view of the fact that soft glass sample containers made before 1960 could have added alkalinity up to 100 microeq per liter to the sample during storage. Methods and instruments used in the older work should be known precisely and tried on representative samples to discover inherent errors. The pH of water stored for 5 hours in a well-aged, corroded copper rain gage was 5.9; in a bright, shiny copper container 4.39. Some older methods of determining alkalinity have changed over the years, depending on the chosen end-point color of the indicator or dilution of the indicator. A sample of low alkalinity lake water was tested by three operators. Results were pH of 4.04 + or - 0.10, alkalinity of 244 + or - 23

microeq per liter by the methyl orange method, and 162 + or - 1 by the Gran technique. Thus the older methyl orange method underestimated alkalinity in this case by about 80 microeq per liter compared with the more modern Gran technique. An equation for correcting historical color comparator pH method data produces results within + or - 0.1 pH units. (Cassar-FRC)
W83-02567

KINETIC FRACTIONATION OF CARBON-13 DURING CALCIUM CARBONATE PRECIPITATION,
Commonwealth Scientific and Industrial Research Organization, Floreat Park (Australia). Div. of Land Resources Management.
J. V. Turner.
Geochimica et Cosmochimica Acta, Vol 46, No 7, p 1183-1191, July, 1982. 4 Fig, 2 Tab, 29 Ref.

Descriptors: *Chemistry of precipitation, *Isotope fractionation, *Kinetics, *Carbon, *Calcium carbonate, Calcite, Bicarbonates, Crystal growth, Lakes, Carbonates, Thermodynamics, Minerals, Mineralogy, Equilibrium, Ions, Model studies.

In order to better understand C13 fractionation in freshwater lakes, the kinetic isotope fractionation of C13 during precipitation of calcium cabonate under open system conditions has been investigated. The isotope enrichment factor for the equilibrium of bicarbonate ions and calcium carbonate was found to vary between -0.35 + or - 0.23 and -3.37 + or - 0.36o/oo at 25 degrees, depending on the rate of precipitation and mineralogy. The enrichment of C13 in the solid carbonate phase decreased with increasing precipitation rate. The equilibrium of bicarbonate ions and calcite was estimated to be between -1.83 + or - 0.32 and -2.26 + or - 0.32o/oo based on slow precipitation trials. A surface diffusion crystal growth model was used to describe the combination of kinetic isotope effects on thermodynamic isotope fractionation during rapid diffusion controlled crystal growth. Under slow precipitation conditions, the equilibrium of calcite and aragonite was estimated as -1.4o/oo. However, during rapid precipitation this fractionation seemed reduced, and aragonite was less enriched in C13. (Geiger-FRC)
W83-02570

BORON CONCENTRATION IN THE SOIL SOLUTION UNDER IRRIGATION: A THEORETICAL ANALYSIS,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
Y. W. Jame, W. Nicholaichuk, A. J. Leyshon, and C. A Campbell.
Canadian Journal of Soil Science, Vol 62, No 3, p 461-470, 1982. 1 Fig, 5 Tab, 19 Ref.

Descriptors: *Irrigation, *Boron, *Soil chemistry, Leaching, Adsorption, Model studies, Chemical composition, Soil solution, Soil water.

Current irrigation water criteria for boron (B) are based on the B concentration of either the irrigation water or the soil saturation extract. The effects of the leaching fraction (LF) and the B adsorption capacity (BAC) of the soil on the soil solution concentration have not been considered. This study was designed to develop a predictive model relating soil solution B, concentration at equilibrium to the B concentration in irrigation water and the LF, and to show how the relationship between the B concentration of the soil solution under field conditions and the B concentration of the soil saturation extract can be modelled. The predictive model, derived from the mass balance concept, indicated that at equilibrium the value of the soil solution B in well-drained soil would be close to that of irrigation water, at the soil surface and will increase with depth with the highest value being near the bottom of the root zone where its magnitude is determined primarily on the degree of leaching. It is suggested that the B concentration of the soil saturation extract does not provide a true representation of the soil solution B. In assessing B toxicity, the saturation extract concentration should be converted to the soil solution concentration at the actual water content of the soil. (Baker-FRC)
W83-02574

SALTING-OUT OF METHANE IN SINGLE-SALT SOLUTIONS AT 25 DEGREES C AND BELOW 800 PSIA,
New Orleans Univ., LA. Dept. of Earth Sciences.
R. K. Stoessell, and P. A. Byrne.
Geochimica et Cosmochimica Acta, Vol 46, No 46, No 8, p 1327-1332, August, 1981. 8 Fig, 2 Tab, 18 Ref.

Descriptors: *Methane, *Chemical reactions, *Solubility, Geological studies, Salting-out, Gases, *Dissolved salts.

Aqueous methane solubilities are presented as a function of dissolved salt concentration at 25C and below 800 psia for 11 single salts. At constant pressure and stoichiometric ionic strength the solubilities were significantly higher in solutions containing divalent cations as compared to those containing monovalent cations; solubilities increased in solutions having a common anion in the following cation sequence: sodium, potassium, calcium, and magnesium; and with the exception of the increased salting-out effect of the carbonate anion, solubilities varied almost insignificantly between solutions having a common cation but different anions. Molal salting coefficients were derived from the experimental data for the salts. The use of salting coefficients was discussed in predicting methane solubilities in multisalt fluids equilibrated with a multicomponent gas phase. Solubility data at 25C are needed in multisalt solutions of geochemical interest to fit an empirical equation including a function of the single-salt molal salting coefficients presented in this report. (Baker-FRC)
W83-02583

ADSORPTION OF NATURAL DISSOLVED ORGANIC MATTER AT THE OXIDE/WATER INTERFACE,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. A. Davis.
Geochimca et Cosmochimica Acta, Vol 46, No 11, p 2381-2393, 1982. 12 Fig, 3 Tab, 38 Ref.

Descriptors: *Adsorption, *Organic matter, *Sediment-water interfaces, *Minerals, *Natural waters, *Chemical reactions, Geochemistry, Hydrogen ion concentration, Cations, Anions, Clay minerals, Kaolinite, Silicates.

The reactions of dissolved organic material at the oxide/water interface of inorganic minerals in freshwater systems was studied in the pH range of natural waters (3-11) by adsorption, microelectrophoresis, and photentiometric titration. The three techniques allowed the analysis of the proton stoichiometry of the surface reactions, the role of organic functional groups and surface reactions, the role or organic functional groups and surface hydrolysis in the adsorption process, and the extent of ionization of adsorbed organic compounds. Results showed that natural organic matter is readily adsorbed by alumina and kaolinite in the pH ranges studied. Adsorption takes place by the complexation of surface hydroxyls and the acidic functional group of the organic matter. Almost complete surface coverage by adsorbed organic matter may be expected to occur for alumina, hydrous iron oxides, and the edge sites of aluminosilicates. Most of the acidic functional groups of the adsorbed organic matter are neutralized by protons from solution. The organic coating may exert a great influence on the subsequent adsorption of inorganic cations and anions. (Geiger-FRC)
W83-02584

ENERGY ASPECTS OF EQUILIBRIUM CO-CRYSTALLIZATION FROM AQUEOUS SOLUTION,
Akademiya Nauk SSSR, Moscow. Inst. Geokhimii i Analiticheskoi Khimii.
V. S. Urusov.
Geochemistry International, Vol 17, No 3, p 1-16, 1980. 8 Fig, 5 Tab, 40 Ref.

Descriptors: *Equilibrium, *Energy, *Cocrystallization, Physical properties, Crystals, Solutions, Geochemistry, Salts, Miscibility, Sulfates, Carbonates, Sulfides, Aqueous solutions.

It is shown that the mixing parameters in the solid and liquid phases of the pure substances must be known, in addition to their solubilities, in order to explain observed or predicted coefficients of co-crystallization of isomorphous components from aqueous solution. A particularly large part is played by the energy characteristics of the solid-solution mixing, as these are dependent on the differences in the crystallochemical parameters of the components. The quantitative energy theory of isomorphous miscibility can then be used to calculate the equilibrium cocrystallization coefficients. Comparisons have been made with experiment for binary halides, sulfates, carbonates, sulfides, and other systems, and as a rule the agreement is good; in particular, there is a very decided improvement relative to the ideal-solution approximation. Ways are considered for incorporating the nonideal mixing of the salt components in aqueous solution. The compound-solvent concept is applied to multicomponent mixtures. An explanation is also offered for the dependence of the cocrystallization coefficients on temperature and on the the composition of the solid phase, and these arguments can be used in deducing crystallization conditions. (Author's abstract)
W83-02585

THEORY OF HYDROTHERMAL EQUILIBRIA OF MINERALS OF VARIABLE COMPOSITION,
Akademiya Nauk SSSR, Irkutsk. Inst. Geokhimii.
L. V. Chernyshev.
Geochemistry International, Vol 17, No 3, p 99-108, 1980. 31 Ref.

Descriptors: *Equilibrium, *Minerals, *Hydrothermal studies, Physical properties, Solutions, Aqueous solutions, Salts, Crystallization, Geochemistry, Physicochemical properties.

The activity-product rule is extended to solid phases of vairable composition, and complexing is incorporated, to obtain a system of equations for the equilibrium mass transfer between water-salt solution and solid phases, which applies for solid phases of constant and variable compositions. A description is given of hydrothermal equilibria in which the water-salt solution is considered as a single compound solvent in relation to the deposited minerals. The equilibrium relations between the mineral and the aqueous solution derived for the ion activities still apply within the framework of the complex-solvent model in terms of the overall concentrations of the deposited components. One expects little variation in the overall cocrystallization coefficients under hydrothermal conditions in spite of fairly wide variations in the physicochemical parameters. This indicates prospects for a laboratory study of hydrothermal conditions in spite of fairly wide variations in the physicochemical parameters. This indicates prospects for a laboratory study of hydrothermal equilibria of minerals of variable composition, which act as indicators for the relations between the bulk metal concentrations in hydrothermal solution. (Author's abstract)
W83-02586

ACID-BASE EQUILIBRIUM DURING PHOTOSYNTHESIS IN WATER,
Moscow State Univ. (USSR).
V. S. Savenko.
Hydrobiological Journal, Vol 17, No 6, p 86-92, 1981. 3 Fig, 1 Tab, 12 Ref.

Descriptors: *Photosynthesis, *Model studies, *Chemical reactions, Water chemistry, Organic compounds, Carbonic acids, Boric acid, Surface waters, Natural waters, *USSR, Mozhaysh reservoir.

Using mixed dissociation constants for carbonic and boric acids and instability constants for hydroxocomplexes, a theoretical dependence of total concentration of carbon dioxide in sea and lake water on pH is obtained. Experiments on simulat-

ing photosynthesis in water (bubbline of air without carbon dioxide) and full-scale observations of production-decomposition processes conducted in Mozhayak reservoir showed satisfactory agreement with a theoretical model. The pH-based analysis of production-decomposition processes in promising for classification of fresh and sea water. The data obtained indicate that the daily curve of photosynthesis fits the model of a closed system. In attempts to extend this model to longer periods of time it is necessary to take into account the rate of exchange of carbon dioxide and oxygen between the water and air. (Baker-FRC)
W83-02600

HYDROCHEMICAL EVOLUTION OF THE EAST MIDLANDS TRIASSIC SANDSTONE AQUIFER, ENGLAND,
Institute of Geological Sciences, London (England). Hydrogeology Unit.
W. M. Edmunds, A. H. Bath, and D. L. Miles.
Geochimica et Cosmochimica Acta, Vol 46, No 11, p 2069-2081, 1982. 8 Fig, 4 Tab, 29 Ref.

Descriptors: *Aquifer, *Geochemistry, *Groundwater dating, *Geohydrology, *Aquifer characteristics, Anions, Cations, Trace metals, Trace elements, Model studies, Carbon radioisotopes, Dolomite, *England, East Midlands, Sherwood Sandston aquifer.

A detailed hydrogeochemical analysis was made of the red-bed Sherwood Sandstone (Triassic) aquifer of the East Midlands of England. A radiocarbon model has been used on this area to establish a chronology of groundwaters along the flow line. Groundwater evolution is dominated by carbonate and sulfate mineral solution, precipitation, and oxidation-reduction reactions. Three distinct chronological zones have been identified. In the most recent groundwater supplies of the past 100 years, an oxidizing environment prevails which is dominated by the congruent dissolution of dolomite and inputs of anthropogenic and atmospheric sources. In groundwater of 1,000-10,000 years of age, predominantly reducing conditions prevail along with incongruent dissolution of dolomite. In groundwater over 10,000 years of age, reducing conditions also prevail, but with an approach to isotopic and chemical equilibrium in the carbonate system and a dominance of gypsum dissolution. The principal geochemical reactions and recharge history of the aquifer control the minor and trace element variation. The concentrations of transition metals and other elements are low. Only lithium and potassium ions are added by reactions of silicate minerals. The only additions considered to be of anthropogenic sources are enhanced sulfate and nitrate ions and possibly copper, zinc and lead in the most recent groundwater zone. (Geiger-FRC)
W83-02616

HYDRODYNAMIC CONDITIONS FOR COMPUTER SIMULATION OF PHYSICOCHEMICAL INTERACTIONS IN A WATER-ROCK SYSTEM IN HYDROGEOCHEMICAL FORECASTING: APPLICATION TO CAF2 WITH SOLUTIONS OF VARIOUS COMPOSITIONS,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
S. R. Kraynov, B. N. Ryzhenko, Yu. V. Shvarov, L. V. Vasil'kova, and L. P. Kraynova.
Geochemistry International, Vol 17, No 3, p 17-29, 1980. 5 Fig, 1 Tab, 31 Ref.

Descriptors: *Model studies, *Hydrodynamics, *Forecasting, Geochemical studies, Calcium fluorides, Equilibrium, Groundwater, Geohydrology.

Advantages and disadvantages are demonstrated for computer simulation of the interactions in heterogeneous water-rock systems; equilibrium-thermodynamic methods can be used in elucidating and forecasting hydrogeochemical phenomena. The limits to the application of such simulations are governed by the hydrodynamic conditions related to the state of chemical equilibrium. The actual rates of infiltration of groundwater are low in hydrogeological structures, while the areas of the aquifers within which the heterogeneous systems come to equilibrium may be considerable. This provides great possibilities for applying computer simulation to hydrogeochemical processes in order to elucidate and forecast hydrogeochemical phenomena. (Author's abstract)
W83-02617

DIURNAL VARIATIONS IN ELECTRICAL CONDUCTIVITY OF WATER IN A SMALL STREAM,
Uppsala Univ. (Sweden). Dept. of Hydrology.
U. M. Calles.
Nordic Hydrology, Vol 13, No 3, p 157-164, 1982. 5 Fig, 14 Ref.

Descriptors: *Streams, *Conductivity, *Drainage basins, Diurnal distribution, Chemical properties, Evapotranspiration, Tidal effects, Hydrology, *Sweden.

Diurnal fluctuations in electrical conductivity of water have been noted in a small stream draining a basin 12 square km in size, Kassjoan in Central Sweden. An attempt to explain the cause of these variations is presented. The two influencing factors studied are evapotranspiration and earth tide effects. The bedrock of the catchment is granites, and overburden is till. Bogs cover about 19% of the area, and lakes, 1.3%. Intense forestry in the area has produced large clearcuttings in the drainage basin. Simulation studies suggest that evapotranspiration is at least partly responsible for the diurnal variation in electrical conductivity. In order to study the eventual impact of earth tides on the variation of conductivity 25 precipitation-free days were used. The mean daily variation was computed and subtracted from the series in order to eliminate the influence from meteorological factors with a period of 24 hours. The influence of gravity changing phase during the investigation may also play a part in the findings. The influence from gravity variations is not as clear as that of evapotranspiration and cannot yet be explained. (Baker-FRC)
W83-02776

ACIDIFICATION OF GROUNDWATER IN NORWAY,
Norsk Inst. for Vannforskning, Oslo.
A. Henriksen, and L. A. Kirkhusmo.
Nordic Hydrology, Vol 13, No 3, p 183-192, 1982. 6 Fig, 1 Tab, 12 Ref.

Descriptors: *Chemical properties, *Groundwater, *Acidification, Water properties, *Norway, Surface waters, Lakes, Streams, Alkalinity, Acid rain, Precipitation, Calcium, Magnesium, Sulfates, Chemical composition.

The chemistry of ground and surface water in areas of similar geologic settings were compared by plotting the equivalent concentrations of each component on an XY-diagram. The deviations of each chemical component from the line through the origin and the plot of the two ionic sums (line of proportional composition) give information about the differences in composition of the two types of water. If it is assumed that the geologic conditions of the ground and surface waters are similar when the plots of calcium and magnesium fall close to the ionic sum line, then it is found that the alkalinity is relatively higher and the sulfate concentration is relatively lower in groundwater than in surface water. These findings suggest that in areas influenced by acid precipitation the groundwater is acidified less than the surface water. The groundwater stations studied so far show a regional tendency toward lower pH values in areas where regional lake surveys show low pH in surface waters. These areas include southernmost Norway and parts of eastern Norway. (Baker-FRC)
W83-02793

2L. Estuaries

MODERN SEDIMENT ACCUMULATION AND STRATA FORMATION ON THE AMAZON CONTINENTAL SHELF,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
S. A. Kuehl, C. A. Nittrouer, and D. J. DeMaster.
Marine Geology, Vol 49, No 3-4, p 279-300, 1982. 12 Fig, 1 Tab, 42 Ref.

Descriptors: *Sediment transport, *Sedimentation, *Deltas, *Continental shelf, *Amazon River estuary, Mud, Graphical methods, River mouth, Radioactive tracers, Sand, Sedimentology, Suspended solids, Stratification, Estuaries, Benthic fauna, Jets, *Brazil, Atlantic Ocean.

The formation of fine-scale (<50 cm) strata on the Amazon continental shelf was studied using radiographic and Pb 210 techniques. Three distinct sedimentary areas were identified within the inner shelf mud deposit. The first, comprised of interbedded mud and sand, extended from the river mouth across the inner shelf and exhibited high rates of sedimentation. High sediment accumulation also occurred in a second region consisting of faintly laminated muds on both flanks of the corridor. Relatively low sediment accumulation rates were found in a third region of bioturbated muds. An inverse relationship was observed between sediment accumulation rate and the extent of sedimentary structure alteration by benthic fauna. A first-order sediment budget shows that sediment accumulation on the Amazon shelf between the Brazil-French Guiana border and the Para River nearly equals estimates of sediment discharged by the Amazon River. The present data suggest that the Amazon inner shelf mud deposit is a subaqueous delta prograding seaward over relict basal sands and that a turbulent jet emanates from the river mouth with competence to carry sand as bedload across the inner shelf. The presence of cross-bedded sands in the corridor of interbedded mud and sands supports the theory of a turbulent jet. The faintly laminated muds may be due to rapid deposition of suspended sediments on either side of the jet. (Geiger-FRC)
W83-02463

BEHAVIOR OF URANIUM IN TWO ESTUARIES OF THE SOUTHEASTERN UNITED STATES,
Tokyo Univ. of Fisheries (Japan).
M. Maeda, and H. L. Windom.
Marine Chemistry, Vol 11, No 5, p 427-436, 1982. 5 Fig, 3 Tab, 22 Ref.

Descriptors: *Uranium, Rivers, *Mixing, *Estuaries, Seawater, Tracers, Ogeechee River, Savannah River, Salinity, Particulate matter, *Georgia, *Path of pollutants.

Determination of uranium in water and sediment samples in the Ogeechee and Savannah River estuaries and in the Gulf Stream during December-June 1979-80 indicated that U was removed from estuarine waters at low salinites during low discharge, most likely through precipitation with Fe and Mn and/or flocculation with organic matter. Over half of the Savannah basin lies in the Piedmont Plateau, which contains higher concentrations of U than are in the Coastal Plain soils in which the Ogeechee flows. For Ogeechee and Savannah, respectively, the U concentrations (micrograms per liter) were: dissolved, 0.040-0.051 and 0.026: particulate, 0.028-0.057 and 0.101; and total, 0.073-0.108 and 0.127. Gulf stream samples averaged 3.46 micrograms per liter U. U concentrations (micrograms per liter) in the sediment particles larger than 3 microns were 0.029-0.050 in the Ogeechee and 0.088-0.204 in the Savannah. In the rivers the U234/U238 ratios in dissolved U were 1.04 + or - 0.04 to 1.08 + or - 0.12 vs 1.15 in the seawater. Particulate U234/U238 ratios in the rivers were 0.70 + or - 0.27 to 1.18 + or - 0.20. The small difference in U concentrations between the 2 rivers showed that it was not feasible to use U as a tracer to determine the influences of each river on coastal water. (Cassar-FRC)
W83-02465

SEASONAL VARIABILITY OF BIOLOGICAL ARSENIC METHYLATION IN THE ESTUARY OF THE RIVER BEAULIEU,
Southampton Univ. (England). Dept. of Chemistry.

For primary bibliographic entry see Field 5B.
W83-02471

ENERGY FLOW IN A TIDAL FLAT ECOSYSTEM,
Nederlands Inst. voor Onderzoek der Zee, Texel.
B. R. Kuipers, P. A. W. J. deWilde, and F. Creutzberg.
Marine Ecology, Vol 5, No 2, p 215-221, May, 1982. 2 Fig, 1 Tab, 38 Ref.

Descriptors: *Tidal flats, *Energy, *Food chains, *Trophic level, *Macroinvertebrates, *Ecosystems, Tidal marshes, Primary productivity, Aquatic productivity, Secondary productivity, Benthos, Aquatic animals, Aquatic plants, Wadden Sea, *The Netherlands.

The transfer of energy through a tidal flat biosystem in the western Wadden Sea is reevaluated. Previous concepts of energy flow through such ecosystems have maintained that the secondary level is primarily herbivorous macrobenthos with an excessive primary food supply and that the higher trophic levels are food limited. A modified concept of energy flow, based on available estimates of primary production, input of allochthonous organic matter, and consumption and production at different trophic levels is proposed, which establishes the importance of the 'small food web' as a source of food for macrobenthos. This group, in addition to bacteria, consists of microfauna, meiofauna, temporary meiofauna, and small macrofauna. It is proposed that the small food web contributes far more to primary consumption and to the production of food for small carnivores than has generally been assumed in food chain studies conducted in the western Wadden Sea. (Geiger-FRC)
W83-02475

CARBON INPUTS TO BIVALVE MOLLUSKS: A COMPARISON OF TWO ESTUARIES,
Washington Univ., Seattle. School of Fisheries.
L. S. Incze, L. M. Mayer, E. B. Sherr, and S. A. Macko.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 10, p 1348-1352, October, 1982. 2 Fig, 2 Tab, 20 Ref.

Descriptors: *Organic matter, *Mollusks, *Isotope studies, *Carbon isotopes, Estuaries, Rivers, Sheepscot estuary, Damariscotta Estuary, *Maine, Invertebrates.

Carbon isotope ratios of particulate organic carbon (POC) and tissues of bivalves were studied in two Maine estuaries: Sheepscot, which has extensive river input, and Damariscotta, which has little river input. Delta C13 values (in o/oo) in Sheepscot varied from -23.8 to -25.0 in POC and from -18.7 to -21.8 in bivalve tissue; in Sheepscot tributaries, -24.2 to 25.3 in POC and -22.0 to -22.5 in bivalve tissue; in Damariscotta, from -21.0 to -22.0 in POC and -16.5 to 18.8 in bivalve tissue. Delta C13 values in Sheepscot showed a systematic landward decrease, whereas values for the Damariscotta were nearly uniform throughout its length. In some locations departures from the trends were seen as a result of locally abundant, isotopically distinct macrophytes in an area of seasonally low flushing or surface deposit feeding on benthic microalgae with anomalously high delta C13 values. (Cassar-FRC)
W83-02548

WATER EXCHANGE BETWEEN SEA AND OPEN ESTUARIES OF THE NORTHWESTERN COAST OF THE BLACK SEA,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. M. Timchenko, V. L. Gil'man, and B. P. Nadtochiy.
Hydrobiological Journal, Vol 17, No 6, p 81-85, 1981. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Estuarine environment, *Water exchange, *Seas, Hydrochemistry, Hydrology, *Black Sea, Estuaries, Tides, Winds, *USSR.

The exchange of water with the sea is an important factor in the hydrology, chemistry and hydrobiology of the estuaries of the northwestern coast of the Black Sea. In the final analysis this exchange determines the economic importance of each of these estuaries, its biological productivity and fish crop. The study demonstrates that tidal- and wind-tide-induced changes in the sea level are the determining factors in water exchange between the sea and the open estuaries of the northwestern coast of the Black Sea. A method is proposed for quantitative determination of the rate of the water exchange between the sea and the estuaries, based on hydrometeorological and astronomic data. However, its extension for other estuaries requires full scale hydrological investigations similar to those described. (Baker-FRC)
W83-02601

TIDAL WAVE ANALYSIS FOR ESTUARIES WITH INTERTIDAL FLATS,
Hanover Univ. (Germany, F.R.). Lehrstuhl fuer Stroemungsmechanik.
K. -P. Holz, and G. Nitsche.
Advances in Water Resources, Vol 5, No 3, p 142-148, September, 1982. 8 Fig, 13 Ref.

Descriptors: *Estuaries, *Tidal waves, *Finite element method, Mathematical studies, Intertidal areas, Model studies, Hydrodynamics, Channel flow, Flow analysis, Tidal flats, Tidal currents, German Bight, *Federal Republic of Germany.

Simulation of the flow in interidal flats structured by deep tidal channels is rather complicated. It can be performed in different ways which depend on the main interest of the investigation. If a tidal wave propagation must be analyzed in a deep water region which is only slightly influenced by the dynamics on the flats, rather simple strategies may be used. But if the flow on the flats themselves has to be modelled, more accurate strategies must be applied. This is demonstrated in two examples. An application of such analysis was made during an investigation on the island Minsener Oog in the German Bight. This island is an artificial island, formed from deposits from extended dredging of navigation channels. The island itself is fortified by an irregular system of groynes. For the computation, a grid net with 764 nodes and 1396 elements was used. Only by this refinement local details could be reproduced satisfactorily. The time step of the computation was 15 sec. The flow field during rising water is diagramed. It is evident that the numerical model represents many details correctly, even locally observed eddies. (Baker-FRC)
W83-02637

TROPHIC ENERGETICS IN ACRTIC FRESHWATER ECOSYSTEMS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. M. Schell, and P. Ziemann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191882. Price codes: A03 in paper copy, A01 in microfiche. Completion Report 8-11, February 1983. 30 p, 8 Fig, 2 Tab, 12 Ref. OWRT A-069-ALAS(2), 14-34-0001-2101.

Descriptors: *Aquatic productivity, Primary productivity, Food chain, Food pyramids, *Food webs, Limnology, Rivers, Ecology, *Detritus, Aquatic life, Alaskan rivers, *Alaska, Colville River, Harrison Bay, *Organic carbon, *Anadromous fish.

The inputs of organic carbon from the Colville River and from shoreline erosion to Harrison Bay dominate the energy input to this system. This large input of aliochthonous carbon is utilized by microorganisms and the secondary production is sampled from Harrison Bay during November, based on the carbon-14 content of the amphipods. The anadromous fishes entering marine waters attain an isotopic composition typical of marine fishes by late summer. Upon entering the freshwater system, however, the foodweb dependencies shift drastically and by spring, the anadromous fishes sampled (least cisco, broad whitefish) were almost completely derived from peat as indicated by a large depression in C-14 content. These data indicate two critical facts regarding anadromous fish populations: 1. Overwintering anadromous fishes in the Colville River feed actively and turn over their entire body carbon. They do not overwinter on fat reserves acquired during summer marine feeding. 2. Overwintering fishes are heavily dependent upon peat as an energy source, probably via insect larvae as principal consumers. By June, least cisco and broad whitefish are 69-65% peat carbon.
W83-02735

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

STUDY OF ICE CRYSTAL FORMATION IN TUBES UNDER STEADY FLOW CONDITIONS AS RELATING TO FREEZE DESALINATION,
Chicago Bridge and Iron Co., Oak Brook, IL.
W. S. Schoerner, T. R. Carbery, and T. J. Nowak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190462, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, July 1981. 95 p, 25 Fig, 12 Tab, 20 Ref. 4 Append. OWRT C-80326-S(No 8555)(1), 14-34-0001-8555.

Descriptors: *Desalination, *Freezing, *Crystallization, Conceptual design, Eutectic, Permeability, Heat transfer, *Indirect freeze crystallization, Surface freezing.

A test loop was assembled to investigate several designs for indirect freeze crystallization of brine solutions. Various parameters were monitored to determine the conditions that allow successful production of ice crystals in the flowing brine. At certain stages in this investigation, problems were identified and modifications were made to correct the difficulties. The initial cyrstallizer was an aluminum double pipe heat exchanger which was not effective because of ice blockage of the brine flow. The first major breakthrough was achieved with tubular and falling film crystallizers. Specific plastic films and surface treatments were helpful in eliminating ice adhesion. The effects of brine concentration, flow rate, heat flux, and ice fraction were studied to ascertain favorable parameters for ice crystal production. Based on the experimental work described in this report, a conceptual design for a 2000 gallon per day indirect freeze crystallizer was prepared. Additional experimental data included as amendments to this contract are presented in Appendices 3 and 4. These sections cover the determination of ice crystal size and investigation of the indirect freeze process for eutectic crystallization.
W83-02481

SIDESTREAM TREATMENT OF HIGH SILICA COOLING WATER AND REVERSE OSMOSIS DESALINATION IN GEOTHERMAL POWER GENERATION,
Permutit Co., Inc., Paramus, NJ.
A. B. Mindler, and S. T. Bateman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190678, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, January 1981. 75 p, 10 Tab, 12 Fig, 11 Ref, 3 Append. OWRT C-90093-D(No 9527)(1), 14-34-0001-9527.

Descriptors: *Silica, *Cooling water, *Geothermal power, *Reverse Osmosis, *Desalination, *Water reuse, *Corrosion, Pilot plants, Iron oxides, Idaho.

Bench scale and pilot plant test work has been performed on cooling water for silica reduction and water reuse, at DOE's Raft River Geothermal Site, Malta, Idaho in cooperation with EG&G(Idaho), Inc. Technical supervision was by Permutit. A novel process of rusting iron shavings was found effective and economical in reducing silica to less than 20 mg/l. Reverse Osmosis was investigated for water reuse after pretreatment and ion exchange softening. The original objective of

treating only a sidestream of the circulating water had to be modified in the course of field work for the following reasons: Corrosion tests on carbon steel indicated that the chloride content of circulating water had to be greatly reduced to minimize chloride pitting. The planned corrosion inhibition by chromate was recognized as no longer environmentally acceptable, requiring evaluation of nonchromate inhibition. The economies of the rusting iron process made it desirable for desilicizing geothermal make-up water in addition to sidestream treatment. Due to the short operating time available, the pilot plant work was limited to study of the individual unit operations instead of a complete system. Demonstration as an integrated system is planned in a continuation program.
W83-02486

NOVEL POLYMERS IN ASYMMETRIC AND COMPOSITE REVERSE OSMOSIS MEMBRANES,
Gulf South Research Inst., New Orleans, PA. Polymer Dept.
I. Cabasso, and B. L. Zimny.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-189977, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, February 1981. 94 p, 63 Fig, 6 Tab. OWRT C-80315-S(No 8540)(1), C-90254-S(No 9420)(1).

Descriptors: *Permselective membranes, *Semi permeable membranes, *Reverse osmosis, Saline water conversion, Brackish water conversion, *Desalination, Membrane processes, Desalination apparatus, *Asymmetric(Anisotropic) membranes, *Poly(Bromophenylene oxide dimethyl phosphonate ester), * Poly(Phenylene oxide dimethyl phosphonate ester), *Alkaline-resistant RO membranes, *Chlorine-resistant RO membranes, Membrane morphology studies.

Synthesis and optimization of symmetric (anisotropic) membranes for reverse osmosis from specially tailored polymers was investigated. The polymers consisted of a hydrophobic skeleton, poly(2,6-dimethyl-1,4-phenylene oxide)-PRO, modified with hydrophilic pendent moieties, dimethyl or diethyl phosphonate ester groups. The hydrophilicity of the resulting polymers was controlled by the degrees of phosphonate substitution, while characteristic properties of the hydrophobic skeleton guarded against matrix collapse or gross dimensional changes upon exposure to wet-dry cycles. Because of this unique structural stability, it was possible to carry out an extensive investigation of asymmetric membrane morphology by scanning electron microscopy before and after testing. An ultrathin skin resting on a porous matrix was observed in all relevent reverse-osmosis membranes. The mechanical properties, chemical resistance and transport characteristics of the membranes were evaluated with a variety of feed solutes, at pH extremes, against temperature gradients and with excessive levels of chlorine for periods up to seven months. Membranes were prepared for both low and hydraulic pressure applications which have flux and salt separation (5-50 gfd corresponding to 85-90% salt rejection). Membranes prepared from brominated polyphosphonate displayed excellent chlorine resistance. All membranes were operative in alkali up to pH 13.5; salt separation actually increased with rising pH.
W83-02502

EFFECT OF RECOVERY ON DESALINATION OF THE BLACK SEA WATER BY REVERSE OSMOSIS,
Higher Inst. of Chemical Technology, Burgas (Bulgaria). Dept. of Water Technology.
I. Dobrevsky, V. Mavrov, and B. Bonev.
Desalination, Vol 41, No 2, p 209-214, 1982. 5 Fig, 2 Tab, 2 Ref.

Descriptors: *Desalination, *Reverse osmosis, *Ultrafiltration, *Desalination plants, Pretreatment of water, Water treatment, Chlorination, Sedimentation, Membrane processes. Filtration, Salt water, Turbudity, Black Sea, *Bulgaria, *Freshwater recovery.

Freshwater recovery was studied during Black Sea water reverse osmosis desalination with cellulose acetate tubular membranes. Two kinds of pretreatment units were evaluated for removal of turbidity components such as colloidal particles, bacteria, and microorganisms. Pretreatment was by chlorination, sedimentation, in-line coagulation, filtration on up-flow multi-media filter, polishing sand filtration, and dechlorination, or by sand filtration and ultrafiltration. Ultrafiltration was found to be an effective alternative pretreatment. With up to 30% recovery, product flux, salt and specific ionic rejection were fairly stable in RO desalination. No technological advantages were found for Ca ion removal before RO desalination using tubular membranes. The RO system was used with water from the Burgas region, with a salinity of 16,000 to 18,000 mg/liter. (Small-FRC)
W83-02522

PERFORMANCE EVALUATION AND PROCESS DESIGN OF AN ELECTODIALYSIS PLANT BY OVERPOTENTIAL MEASUREMENTS,
Istituto di Ricerca sulle Acque, Rome (Italy).
R. Passino, C. Marra, A. Rozzi, and G. Tiravanti.
Desalination, Vol 41, No 2, p 181-197, 1982. 8 Fig, 1 Tab, 18 Ref.

Descriptors: *Desalination, *Electrodialysis, *Desalination plants, *Boundary layers, Membrane processes, Electric currents, Conductivity, Water treatment, *Italy.

The Ionics Mark III electrodialysis plant stack was evaluated as a series of elementary subsystems. Concentration boundary layer over-potentials were measured at different locations along the membrane flow path. There is a correlation between the boundary layer overpotential and other parameters, including voltage applied, current density, and bulk and interfacial concentrations. These correlations were used to develop a design procedure for a regular scale ED unit, specifically the Ionics Mark III stack. Equations are presented for the calculation of the concentration boundary layer thickness based on electrical parameters and for the calculation of the boundary layer overpotential. With this method, polarization conditions in large scale plants can be monitored using suitable reversible electrodes. (Small-FRC)
W83-02523

SHIP-MOUNTED SEAWATER 2500 CU M/D FLASH EVAPORATION PLANT FOR ADU DHABI. ECONOMICAL DRINKING WATER FOR ARID REGIONS,
Buckau-Walther A.G., Essen (Germany, F.R.). Water Engineering Div.
K. Wangnick.
Desalination, Vol 41, No 2, p 171-180, 1982. 7 Fig, 1 Tab.

Descriptors: *Desalination plants, *Desalination, *Floating plants, *Water treatment facilities, *Drinking water, Water treatment, Demineralization, Water shortage, Industrial plants, *United Arab Emirates, *Adu Dhabi.

The first self-propelled floating seawater desalination plant built for commercial use consists of a pontoon-like hull carrying two centrally positioned desalination units of 1250 cu m each. It will supply islands, coastal towns, and major construction sites in the United Arab Emirates with drinking water as well as provide a backup to existing desalination plants to alleviate plantation water shortages. With an annual output of 821,250 cu m of drinking water, a depreciation period of 20 years, and an interest rate of 10%, one cu m of drinking water from a floating unit costs 3.14 DM, while from a typical onshore unit it costs 4.43 DM. Floating plants are cost efficient for remote areas, offer lower water production costs, have a shorter water delivery period, and are available for emergencies. (Small-FRC)
W83-02524

OPERATION OF MEFF DESALINATION PLANT (MULTIPLE EFFECT FALLING FILM PROCESS),
Toyo Engineering Corp., Tokyo (Japan).
S. Kido.
Desalination, Vol 41, No 2, p 127-136, 1982. 6 Fig, 2 Tab, 3 Ref.

Descriptors: *Desalination plants, *Desalination, *Evaporators, *Condensers, Water treatment, Demineralization, Industrial plants, Brines, Water treatment facilities, Abu Dhabi, *United Arab Emirates.

A 2273 cu m/day MEFF (Multiple Effect Falling Film) sea water desalination plant was constructed in Abu Dhabi, United Arab Emirates. The plant, which consists of evaporators, preheater, condenser, and deaerators, is now in continuous operation. Productivity and utilities consumption data indicate that the plant could continuously produce the distillate at 105% of designed value, which is limited by the steam generation capacity of the boiler. The pH value of the brine in the evaporator has been extremely stable. The plant can operate continuously and steadily within a load flexibility range of 20 to 100%. This plant was tested in Japan, then disassembled for transport to Abu Dhabi. (Small-FRC)
W83-02525

MATHEMATICAL MODEL OF A MECHANICAL VAPOUR COMPRESSION EVAPORATOR. APPLICATION TO SEAWATER DESALTING. PART I-THE MODEL SETTLEMENT,
Institut de Genie Chimique de Toulouse (France).
D. Aussenac, S. Domenech, and M. Enjalbert.
Desalination, Vol 41, No 2, p 137-169, 1982. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Desalination, *Evaporators, *Desalination plants, *Mathematical models, Mathematical equations, Pilot plants, Condensers, Water treatment, Water treatment facilities, Demineralization, France.

The performance of a mechanical vapor compression evaporator was analyzed for the production of fresh water by seawater desalination. A mathematical simulation model was developed for the system. The pilot plant was designed for the produciton of 75 cu m/day of freshwater from seawater varying in temperature from 15 to 35 deg C with a salinity between 30 and 35 g of mineral salts/kg. The plant first boils the seawater in an evaporator-condenser, then the vapor passes through a compressor. Non-condensables are extracted. Equations were developed for the overall mass and heat balance as well as for the partial mass balance of each modulus. The algebraic system which must be solved consists of 265 unknowns and 215 equations. Part II of this work will identify model parameters. (Small-FRC)
W83-02526

WORLD'S FIRST SOLAR POWERED REVERSE OSMOSIS DESALINATION PLANT,
Water Services of America, Inc., Milwaukee, WI.
W. W. Boesch.
Desalination, Vol 41, No 2, p 233-237, 1982. 5 Fig.

Descriptors: *Desalination, *Desalination plants, *Reverse osmosis, *Drinking water, *Electric power, Digital computers, Logging (recording), Mathematical models, Water treatment, Jeddah, *Saudi Arabia, Red Sea.

The World's first solar-powered seawater reverse osmosis plant which is operating in Jeddah, Saudi Arabia, on the eastern shore of the Red Sea, is described. The system provides for the drinking water needs of a community of 250 people and also provides power for a complete digital logging system. The RO system has two membrane stages. The 42,800 ppm salinity water enters two parallel-connected DuPont B-10 permeators after acidification and filtration. Product water is then repressurized and pumped to two B-9 permeators, reject-staged. Overall recovery is 22% with a product flow of 1.2 gallons per minute. A digital computer records 48 variables every six minutes. The data are being used to verify computer models. The plant power source is an 8 kW (peak) array of

ribbon photovoltaic modules. Overall array efficiency is 7.5%. (Small-FRC)
W83-02547

DEVELOPMENT OF FT-30 MEMBRANES IN SPIRAL WOUND MODULES,
FilmTec Corp., Minneapolis, MN.
R. J. Petersen, J. E. Cadotte, and J. M. Buettner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191775, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, October 1982. 76 p, 14 Fig, 10 Tab, 9 Ref. OWRT C-80318-S (No 8547)(1).

Descriptors: *Desalination, *Reverse osmosis, *Permselective membranes, *Semipermeable membranes, Seawater, Brackish water, Desalination apparatus, Chlorine, Polymers.

The objective of this program was to enhance the development of a new thin-film-composite desalination membrane, named FT-30, into commercially attractive spiralwound reverse osmosis elements for seawater and low pressure brackish water applications. This membrane consists of a novel crosslinked aromatic polyamide formed on microporous polysulfone, itself supported by woven or nonwoven polyester webs. Studies centered on the optimization of polysulfone substrate and membrane fabrication parameters, and long term tests on FT-30 spiral elements on tapwater, brackish water and sweater. FT-30 membrane elements showed 15 gfd and 98% salt rejection towards 0.3% TDS brackish water at 200 psi and 25C in a two year test. Single pass seawater desalination was demonstrated in concurrent seawater trials. The membrane was not fully resistant to chlorine, showing salt rejection losses after 500 to 1500 hours exposure to 0.5 ppm chlorine, but was stable during 4000 hours exposure to chlorine dioxide. W83-02722

POLARIZATION PHENOMENA IN ELECTRODIALYSIS SYSTEMS,
California Univ., Berkeley. Water Thermal and Chemical Technology Center.
J. Sinkovic, T. Vermeulen, and C. C. Herrmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191866, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, June 1982. 49 p, 19 Fig, 4 Tab, 5 Ref, 3 Append. OWRT C-90164-S(No 0436)(1), 14-34-001-0436.

Descriptors: *Electrodialysis, *Ion-exchange membranes, *Diffusion layer thickness, *Transport number, *Limiting current desity, Prediction, Voltage drops, Computer programs, Membrane processes, *Desalination.

Two single ion-exchange membranes, one anionic (Ionics, 103 QZL-386) and one cationic (Ionics, 61 CZL 386) were investigated in 0.01 N KCl at several velocities. The limiting current density, (i.c.d.) was found to vary with the method employed, implying a range rather than a unique value. The data were used to modify the constant in the Blasius-Howarth equation for diffusion layer thickness, as employed to calculate i.c.d. at concentrations along the flow path. A computer program has been developed to obtain computed concentrations on the diluate and concentrate sides of anion or cation exchange membranes, and to predict voltage drops across the membrane along the flow path. Treating the transport numbers as variables extends the calculations into the acid-base generation region when the i.c.d. is exceeded. W83-02731

CHARACTERIZATION OF FOULING POTENTIAL FOR PRESSURE-DRIVEN MEMBRANE PROCESSES: A NEW SIMULATED FLOW CELL,
Rensselaer Polytechnic Inst., Troy, NY.
R. H. Reed, and G. Belfort.
Water Science and Technology, Vol 14, No 6/7, p 499-522, 1982. 9 Fig, 4 Tab, 41 Ref.

Descriptors: *Membrane processes, *Model studies, Flow measurement, *Fouling, *Membranes, Demineralization, *Desalination, Delsalination apparatus, Reynolds number.

A new Simulated Flow Cell has been successfully tested both in the laboratory and in the field. The SFC design has the following advantages. The axial flow across the membrane surface can be varied from a Reynolds number of zero to about 6000, thus simulating flow conditions in membrane modules. All flow regimes, laminar, transitional and turbulent, can be modelled using the SFC. The SFC, operated with 30 psig center pressure, can be used under the same conditions as the Non-Flow-Cell (NFC) has been in the past. The SFC is simple to use and can predict the benefits of axial flow. The low pressure operating range allows the SFC to be constructed of plastic instead of expensive stainless steel. The SFC produced the same plugging as the NFC when both units were operated under the same conditions. The Nuclepore membranes were extremely sensitive to fouling, especially the smaller pore sized membranes. The 0.1 micron Nuclepore membrane proved to be the best choice for flow studies using PSL shears. Pressure drop measurements indicated that the SFC had laminar flow up to a Reynolds number of about 1500 and was in fully turbulent flow by a Reynolds number of about 2500. Specific cake resitance decreased with increasing Reynolds number, reaching a relatively constant value at about Re 1500 to 2000. (Baker-FRC)
W83-02745

DESALINATION BY CONTINUOUS ION EXCHANGE BASED ON THERMALLY REGENERABLE MAGNETIC MICRORESINS,
Commonwealth Scientific and Industrial Research Organization, South Melbourne (Australia). Div. of Chemical Technology.
B. A. Bolto, E. A. Swinton, P. R. Nadebaum, and R. W. Murtagh.
Water Science and Technology, Vol 14, No 6/7, p 523-534, 1982. 8 Fig, 1 Tab, 12 Ref.

Descriptors: *Desalination, Water resources develpment, Water supply, *Ion exchange, *Resins, *Microresins, Demineralization, Thermal regeneration, *Australia.

This paper describes the unique hydrodynamic and kinetic properties of 'Sirotherm' thermally regenerable desalting resins when made in the form of magnetic microbeads and the development of continuous contacting systems which exploit these properties. A novel multistage contactor has been evaluated on laboratory and pilot plant scales. A prototype plant with a throughput of 1 ML/day is to be installed near Perth, Western Australia,in order to demonstrate the process. It is truly continuous, simple and economic and does not require preclarification of the raw water. Various experiments were conducted with the system which indicated that reducing particle size of the resins increased the rate of reactions. For resins with fast kinetics, film diffusion was usually the controlling factor. However, if the hydrodynamic conditions could be made so turbulent that liquid film resistance was lowered, then intraparticle diffusion became the controlling factor and an even greater benefit could be derived from particle size, inversely proportional to the square of the diameter. The effects of magnetic properties on the handling characteristics of small particles are also discussed. (Baker-FRC)
W83-02748

CONTINUOUS COUNTERCURRENT ION EXCHANGE FOR DESALINATION AND TERTIARY TREATMENT OF EFFLUENTS AND OTHER BRACKISH WATERS,
Cape Town Univ. (South Africa). Dept. of Chemical Engineering.
B. A. Hendry.
Water Science and Technology, Vol 14, No 6/7, p 535-552, 1982. 5 Fig, 6 Tab, 3 Ref.

Descriptors: *Ion exchange, *Desalination, *Tertiary water treatment, *Brackish waters, Water treatment, *Demineralization, Resins, Continuous countercurrent ion exchange.

A continuous countercurrent ion exchange (CCIX) process has been developed for desalination of mineralized effluents and other brackish waters. The process uses macroporous resins in a strong cation/weak anion sequence. Removal of organic matter by the anion resin results in color and odor removal and about 70% reduction of the chemical oxygen demand of humus tank effluent. No pretreatment is needed, and the resin has been in use over the equivalent of more than two years of continuous operation without significant fouling or loss of capacity. Any required degree of desalination is attainable. The basic four column system of coutercurrent fluidized bed multistage contactors attains greater than 80% water recovery using up to 1.0 N sulfuric acid and 0.2N lime slurry as regenerants. Calcium content of feedwater affects water recovery. The capital cost estimate for a 10,000 kl/day plant is R5 million, while unit costs of water are 30 to 40 c/kl for removal of 500 mg/l TDS. Present work involves lime contacting improvements and evaluation of carbon adsorption polishing of the ion exchange product to produce potable water. (Baker-FRC)
W83-02792

3B. Water Yield Improvement

STORING MONSOON RAINFALL IN INDIAN RESERVOIRS,
Indian Inst. of Tropical Meteorology, Poona. Hydromet Research Div.
O. N. Dhar, P. R. Rakhecha, and B. N. Mandal.
International Water Power and Dam Construction, Vol 34, No 6, p 26-29, June, 1982. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *Water resources development, *Water supply development, *Reservoir storage, *Storage reservoirs, *Monsoons, *India, *Storage capacity, Reservoirs, Water storage, Dams, Rainfall, Surface runoff, Runoff volume.

In Inida, a growing population and expansions in agriculture and industry have made development of available water resources a high priority item. Water from the monsoons which occur from June to September provides sufficient supplies for these needs, but new storage reservoirs are needed to fully utilize these resources. Present available storage is able to contain only about 20% of the usable flow. Assuming that only 50% of the monsoon rainfall becomes runoff, and using the known maximum storage capacity of certain reservoirs, the additional unused rainfall percentages for the major dams on monsoon-fed rivers in India were calculated. Results showed that about 92% of monsoon rainfall remains unused. It is only in a few river basins such as the Mahi, Hasedo and Chambal that about 70 to 75% of monsoon rainfall is used. In most dams, only 5 to 15% of the total monsoon rainfall is stored. The development of reservoir storage of monsoon runoff will help protect against flooding as well as provide water for irrigation and energy generation. (Geiger-FRC)
W83-02571

FEASIBILITY OF INCREASING WATER SUPPLIES AND PREVENTING ENVIRONMENTAL DAMAGE BY ARTIFICIAL RECHARGE IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
W. S. Motts, K. O'Brien, S. Walen, and D. Haines.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191833, Price codes: A12 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 132, Massuchusetts University, Amherst, January 1983. 251 p, 45 Fig, 11 Tab, 62 Ref, 1 Append. OWRT B-067-MASS(1), 14-34-0001-9076.

Descriptors: *Artificial recharge, Groundwater, *Groundwater recharge, Seepage, Boundary processes, Artesian basins, Municipal water, *Water supply development, Potable water, *Massachusetts.

Successively more detailed first, second and third-level approximation methods show that artificial

recharge (AR) is a viable, cost effective and environmentally advantageous method for many localities in Massachusetts. First-level approximation (overview) methods indicate highly or potentially favorable AR conditions adjacent to 52.8% of the 650 municipal wells which occur in 126 (or 38.3%) of 329 state towns. Furthermore, 41.6% of the towns now without municipal wells could have future AR potential if groundwater supplies are developed. The second-level approximation method, a basin-wide study of the Ipswich Basin, showed favorable AR conditions in the towns of Danvers, Middleton, and Ispwich. Detailed third-level approximation studies showed favorable AR conditions in Amherst, Holden, Pittsfield, and Fairhaven. All water development plans including AR should be designed to obtain a water supply with lowest economic and environmental cost. The following plan for a typical Massachusetts community proceeds through successively more costly alternatives: (1) conservation and/or analysis of distribution and storage systems, (2) groundwater, (3) artificial recharge and water salvage, (4) development and treatment of ferromanganese water, (5) as a last resort more expensive alternatives including surface water reservoirs, water diversion, and tertiary treatment of contaminated sources.
W83-02728

THE HUNDRED-YEAR EFFORT TO SECURE HONG KONG'S WATER SUPPLY (HUNDERT-JAHRIGES BEMUHEN UM HONG KONG'S WASSERVERSORGUNG),
H. Lindner.
Wasserwirtschaft, Vol 71, No 5, p 146-147, May 1981 3 Fig, 1 Ref. (No English Summmary).

Descriptors: *Water supply development, *Water scarcity, Water importing, *Reservoirs, *Catchment areas, Catchment basins, *Hong Kong, Reservoir construction, Water demand, China, Water resources development, Water supply, Desalination plants, History.

The history of the development of Hong Kong's water supply is described. The main problem of water procurement is that Hong Kong is a small region of dense population with few natural catchment areas. Catchment areas have been produced by means of collection basins on mountainsides, where the water otherwise flow quickly and directly into the sea or into valleys unsuitable for reservoir construction. However, the last two major projects have abandoned this practice in favor of an underground tunnel and shaft system with a total length of 225 km to avoid further disfigurement of the landscape and the danger of landslides. The water supply system consists of 2 reservoirs in the sea, 16 conventional reservoirs, one of the world's largest desalination plants (181,800 cu m/day throughput), 14 water treatment plants, and approximately one-third (350 sq km) of its landmass used as a catchment area. Water procurement began in 1860 with the first waterworks in Victoria City and the first reservoir. The first water treatment facility became operational in 1889, and many reservoirs were constructed during the ensuing 60 years. However, until 1967, a restricted water supply was the rule rather than the exception. The first ocean reservoir was built at Plover Cove in the New Territories in the 1960s by dredging, damming, and emptying an inlet; its original capacity was 170 million cu m, expanded to 230 million cu m in 1973. In 1971, the narrows between High Island and the Sai Kung Peninsula were dammed at either end to form a reservoir with a capacity of 273 million cu m. To supplement its own supply, Hong Kong imports water from China. The first contract was signed in 1960 for 22.73 million cu m/yr, while a 1980 contract was signed for an average yearly increase of 35 million cu m from 1983 over the present 182 million cu m/yr. In 1980, China covered more than one-third of the total supply of about 1.3 million cu m/day. The demand is estimated to be 1,022 cu m/yr by 1995. (Gish-FRC)
W83-02762

3C. Use Of Water Of Impaired Quality

MAXIMIZING AQUACULTURAL POTENTIAL IN MUNICIPAL WASTEWATER PONDS,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
D. L. King, and C. N. Spencer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190660, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research Publication No B-052, Michigan State Univ., East Lansing, February 1983. 38 p, 12 Fig, 41 Ref. OWRT B-052-MICH(1), 14-31-0001-9077.

Descriptors: Fish, Bass, Fathead minnows, Sticklebacks, Aquatic plants, *Wastewater treatment ponds, Nutrients, *Zooplankton, *Cladoceran, *Periphyton, *Aquaculture, *Michigan, *Aquatic plant control.

Factors controlling the composition and growth of aquatic plants were investigated in four wastewater treatment ponds in southern Michigan. These ponds contained various densities of predatory fish (largemouth bass) and planktivorous fish (fathead minnows and brook sticklebacks) as well as different nutrient concentrations. Ponds developed either of two dominant plant communities in respone to predation and grazing pressures. In ponds with high densities of planktivorous fish, intense fish predation kept cladoceran zooplankton densities low and phytoplankton formed the dominant plant community. Ponds with low planktivorous fish densities maintained much higher cladoceran densities which effectively grazed the phytoplankton. Macrophytes and periphyton dominated these ponds. Growth limitation and seasonal succession within the dominant plant community were largely controlled by a combination of chemical and physical factors including depletion of inorganic nitrogen and carbon dioxide, and changes in light availability and temperature. With their significant dynamic instability, wastewater ponds in northern climates offer little opportunity for aquaculture of either fish or plants and any attempt at aquaculture will tend to compromise the wastewater treatment capacity of the pond.
W83-02485

SEASONAL VARIATIONS IN SALT AND WATER-CONTENT PROFILES IN SHALLOW AND SALINE GROUNDWATER-TABLE,
Central Soil Salinity Research Inst., Karnal (India).
R. K. Gupta, and B. K. Khosla.
Indian Journal of Agricultural Sciences, Vol 52, No 8, p 506-510, August, 1982. 3 Fig, 11 Ref.

Descriptors: *Seasonal variation, *Soil water table, *Crop production, *Groundwater, *Surface-groundwater relations, Leaching, Soil water, Water table, Agronomy, Salt tolerance, *India.

The trends in seasonal variations in salt and water-content distribution resulting from the occurence of a shallow, saline groundwater-table and its effects on cropping conditions were studied from July 1978 to July 1979 at a typical site in the Sonepat district of Haryana, India. When most of the rains occurred in July and August, the water-table remained close to the soil surface. The removal of salt by rains was followed by a dominant upward flux, resulting in the accumulation of salts in surface layers. Salinization contained through winter and was accentuated in summer due to high evaporative demand. The electrical conductivity of groundwater also increased in summer. Some of these existing conditions can be utilized by impounding rainwater for leaching of salts during the rainy season, and growing salt-tolerant crops during the rainy season, and barley, wheat and colza during winter. Fields may also be kept fallow during the rainy season and then planted with short-duration crops. (Geiger-FRC)
W83-02573

AGRICULTURAL USE OF SUGAR REFINERY WASTEWATER CHANGE IN MINERAL NITROGEN IN SOILS USED FOR LANDSPREADING (VALORISATION AGRICOLE DES EFFLUENTS EN SUCRERIE, ETUDE DE L' EVOLUTION DE L' AZOTE MINERAL DANS LES SOLS SOUMIS AUX EPANDAGES),
BURGEAP S.A., Paris (France).
B. Guerin, and F. Heitz.
Industries Alimentaires Agricoles, Vol 99, No 3, p 133-145, March, 1982. 2 Fig, 5 Tab, 7 Ref.

Descriptors: *Wastewater disposal, *Land disposal, *Nitrogen, Percolation, Infiltration, Leaching, Corn, Crop yield, Irrigation, Fate of pollutants.

During two waste-water land-spreading seasons using flume water experimental data have been gathered. The water charge fluctuated between 120 and 150 mm with every campaign. Nitrogen percolation was observed through a thick loamy non-hydromorphic soil in the north-west of France. Spreading on stubble, previously plowed in large furrows, did not initiate any discernible nitrate percolation, even when a large amount was present in the ground. An intercalary crop, preceding the spreading, did not give any additional advantage in restricting nitrate percolation. Nitrogen introduced with waste water is very incompletely and very slowly nitrified, and was ultimately available for the following crop (corn). Nitrogen fertilizer was partially used and satisfied the early needs of the plant. Prolonged nitrate release will continue to the second following crop. Nitrogen balance between spreading input an cropping out should be computed over two cultivation years with the intention of reducing it. (Baker-FRC)
W83-02633

3D. Conservation In Domestic and Municipal Use

THE EFFECTS OF WATER CONSERVATION ON NEW WATER SUPPLY FOR URBAN COLORADO UTILITIES,
Colorado Univ. at Boulder. Dept. of Civil, Environmental, and Architectural Engineering.
C. Ellinghouse, and G. McCoy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-189951, Price codes: A08 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No 120, Colorado State University, Fort Collins, December 1982. 146 p, 10 Fig, 41 Tab, 23 Ref, 7 Append. OWRT A-049-COLO(1), 14-34-0001-1106.

Descriptors: Conservation, *Water conservation, *Water use efficiency, *Water supply, Water law, Water transfer, Legal aspects, *Water costs, Value, *Water policy, *Colorado, *Utilities, Comparative costs.

A model is developed and used with various scenarios to make a comparison of the costs and benefits of a water conservation program for various sizes and types of Colorado cities. Colorado water law and the scarcity of water encourages cities to acquire more water than they need and to resist conservation because of implied threats that they may lose water they are not currently using. Based on surveys of selected cities, costs of water acquisition from transfers, storage, imports and purchase are evaluated and projected into the future. These costs are compared with the costs of various conservation programs that will modify demand and thus reduce need for additional water. The results of this study show that for all types of cities and all growth rates conservation is the more economic approach to be utilized for urban utilities in Colorado.
W83-02500

AN EVALUTION FRAMEWORK FOR ASSESSING VARIATIONS IN THE COSTS AND BENEFITS OF MUNICIPAL WATER CONSERVATION,
INTASA, Inc., Menlo Park, CA.
For primary bibliographic entry see Field 6B.
W83-02743

3E. Conservation In Industry

URGENT PROBLEMS OF CONSERVATION AND RATIONAL USE OF WATER RESOURCES,
For primary bibliographic entry see Field 5G.
W83-02623

EVALUATION OF BIOLOGICAL ACTIVATED CARBON INDUSTRIAL WATER REUSE,
Jacobs Engineering Group, Inc., Pasadena, CA.
For primary bibliographic entry see Field 5D.
W83-02742

3F. Conservation In Agriculture

THE ECONOMIC IMPACTS OF ALTERNATIVES AND CONTINGENCIES RELATING TO THE 1978 DECISIONS OF THE MONTANA BOARD OF NATURAL RESOURCES ON WATER RESERVATIONS IN THE YELLOWSTONE BASIN,
For primary bibliographic entry see Field 6B.
W83-02493

ANALYSIS OF IRRIGATION PUMPING AND APPLICATION EFFICIENCY IN NEVADA,
Max C. Fleischmann Coll. of Agriculture, Reno, NV. Div. of Agricultural Economics.
T. R. Harris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186528, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, Desert Research Institute Publication No 43010, Univ. of Nevada, Reno, February 1983. 67 p, 17 Tab, 6 Fig, 39 Ref. OWRT A-104-NEV(1), 14-34-0001-2130.

Descriptors: *Nevada, *Alfalfa, Irrigation, Production function, *Irrigation delivery efficiency, Pumping plant efficiency, Alfalfa plant growth model, Irrigation cost generator, *Irrigation strategies, Pumping, Irrigation practices.

Irrigated alfalfa production in Nevada is a major segment of the state's agricultural sector. However, with increasing fuel costs and variable surface water supplies, efficient allocation of water is desired. Determination of profit maximizing quantities of water for Central Nevada under different irrigation delivery and pumping efficiencies were derived. A computer irrigation cost generator from Oklahoma State University was put on the University of Nevada's main frame computer to derive irrigation costs for different electrical charges, water delivery efficiencies, and pumping efficiencies. The study indicates a potential for substantial water and cost savings with improved water delivery and pumping plant efficiencies. Also, soil moisture and alfalfa plant growth relationships were derived through an alfalfa plant growth model from Utah State. The alfalfa plant growth model was put on the main frame computer and verification of the model was performed for a surface water delivery system in Fallon, and a center pivot and surface water delivery system in Diamond Valley, Nevada. After verification, different irrigation strategies were developed for the surface delivery system in Diamond Valley. The irrigation strategy that may be a viable alternative to contemporary practices is to irrigate up to the first cutting and discontinue irrigation for that season.
W83-02499

DRIP IRRIGATION SAVES MONEY IN YOUNG ALMOND ORCHARDS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
E. Fereres, J. R. Castel, D. A. Martinich, E. Holzapfel, and T. M. Aldrich.
California Agriculture, Vol 36, No 9/10, p 12-13, September/October, 1982. 1 Fig, 2 Tab.

Descriptors: *Drip irrigation, *Water conservation, *Irrigation engineering, Irrigation efficiency, Water supply, Irrigation, Evapotranspiration, Evaporation, *Almond orchards, *California, Arbuckle.

A four year evapotranspiration (ET) experiment was conducted in a 40 acre orchard of drip-irrigated young almond trees at the Nickels Soils Laboratory, near Arbuckle, Colusa County. The trees were 3 years old at the start of the study and were irrigated by two micro-tube emitters per tree. The soil, an Arbuckle gravelly sandy loam over a gravelly clay substratum, has low water storage capacity. Young trees that shaded less than 10% of their area at midsummer had more than 20% of the estimated ET of a mature orchard. By the time the six-year-old trees shaded around 42%, their ET was between 85 and 88% of the ET of a mature orchard. The ET of any crop is directly related to the available energy and to the aerodynamic conditions that prevail in the area. For young trees irrigated by drip, where the soil is partially wetted and the tree canopy shades only a fraction of the total area, horizontal energy transfer (advection) from the dry areas surrounding the trees must increase the transpiration rate above that of canopies where the whole soil surface is frequently wetted by rain or irrigation. The water savings potential of drip irrigation is maximum for the first two years of the orchard, then declines as trees grow, and probably becomes very limited after the sixth year. (Baker-FRC)
W83-02521

BORON CONCENTRATION IN THE SOIL SOLUTION UNDER IRRIGATION: A THEORETICAL ANALYSIS,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
For primary bibliographic entry see Field 2K.
W83-02574

COTTON GROWTH RELATED TO PLANT'S WATER STATUS,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. W. Grimes, and H. Yamada.
California Agriculture, Vol 36, No 11/12, p 13-14, November/December, 1982. 4 Fig.

Descriptors: *Water availability, *Irrigation practices, *Moisture stress, *Cotton, *Plant growth, Plant yield, Irrigation, Water supply, Moisture availability, Soils, Soil types, Leaf water potential.

Cotton irrigation scheduling varies greatly in arid and semiarid regions, where large differences occur in soil water retention and transmission properties. Since the plant reflects its total environment, a measurement on the plant to determine its water status will sometimes be a better indication of when irrigation is needed than soil water. The water status, or leaf water potential, of vascular plants can be measured with a pressure chamber. Primary features of the apparatus include the pressure chamber, gauge, and control valve, and a small nitrogen gas tank that provides the pressure. A three year field study was conducted on cotton in the San Joaquin Valley. The tests were on Panocheclay loam and on Wasco sandy loam. Changes in leaf water potential over time for contrasting soils were examined to evaluate the usefulness of this measurement for scheduling irrigations. Treatments that varied timing of the first irrigation of the growing season showed best results when leaf water potential was allowed to decline to about -16 bars just before the irrigation. This degree of stress slowed growth slightly. After substantial root extension and plant conditioning, yields were optimum when midseason irrigations were scheduled at midday leaf water potentials of -18 to -20 bars. At peak bloom results may be improved by irrigation at -18 bars, since the plant is more sensitive to yield loss from excessive stress at this stage. (Baker-FRC)
W83-02576

THE ADAPTATION OF VARIETIES OF SORGHUM TO DIFFERENT WATER REGIMES,
Institut National de Recherches Agronomiques au Niger, Niamey.
For primary bibliographic entry see Field 2I.
W83-02612

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

A MODEL FOR DRAINAGE BENEFITS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
W. D. Lembke, C. J. W. Drablos, J. G. Arnold, and J. N. Scarborough.
Transactions of the ASAE, Vol 25, No 5, p 1329-1332, September/October, 1982. 6 Tab, 15 Ref.

Descriptors: *Drainage, *Model studies, *Crop yield, Runoff, Rainfall-runoff relationships, Farming, *Illinois, Soil properties.

A regression model for corn yield was developed which includes rainfall during two critical periods of the growing season: the time during which spring tillage and planting occurs, and the time during which pollination occurs. The regression model was applied to three widely different situations: eight counties in Illinois that could be grouped according to soil associations with relatively similar drainage problems; three University of Illinois farms in close proximity but with different levels of drainage; and drainage research plots at the University of Illinois Brownstone Research Center. Rainfall during period 1 was found to significantly affect yields on farms with inadequate drainage systems. The model has the potential to be useful in explaining yield differences between well drained and poorly drained farms. (Baker-FRC)
W83-02452

DRAINAGE COEFFICIENTS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
L. S. Willardson.
Transactions of the ASAE, Vol 25, No 5, p 1251-1253, 1257, September/October, 1982. 1 Fig, 14 Ref.

Descriptors: *Drainage coefficient, *Mathematical equations, *Soil water, Arid regions, Humidity, Water table, Drain spacing, Drainage, Drainage patterns.

Drainage coefficients used in humid and arid regions were developed by different methods. The procedure by which the data are handled and the design equation used, steady state or transient, can affect calculated drain spacing. A tensor product Lagrange interpolant is presented that can be used to adjust design water table heights to get equivalent drain spacings using either design method. Drainage coefficients as currently determined can be used without special adjustments. (Baker-FRC)
W83-02454

LAND-USE AND MANAGEMENT PROBLEMS IN THE NILE DELTA,
Ministry of Irrigation, Cairo (Egypt). Research Inst. for Groundwater.
For primary bibliographic entry see Field 6G.
W83-02462

HYDROBIOLOGICAL CONDITIONS IN THE KARAKUMY CANAL,
Akademiya Nauk Turkmenskoi SSR, Ashkhabad. Inst. Botaniki.
Sh. I. Kogan, Yu. Ye. Lyubeznov, Kh. S. Sadykov, M. A. Kemzhayev, and A. P. Gaipova.
Hydrobiological Journal, Vol 17, No 6, p 9-18, 1981. 3 Fig, 7 Tab, 34 Ref.

Descriptors: Water quality, *Canals, *Vegetation, Turbidity, Plant growth, *Hydrobiology, Eutrophication, Biomass, Phytoplankton, Macrophytes, Algal growth, *USSR, Karakumy Canal.

The Karakumy canal is a prototype of a long, high-throughput waterway, diverting water from

Siberian rivers to and through desert regions. Data on its hydrology, chemistry and vegetation 25 years after opening of the first section are presented, concentrating on the effects of plant life on water quality and canal operation. One of the factors which has a very strong effect on the hydrobiology of the canal is its high turbidity. The chemical composition of the canal water depends on the conditions in the Amu Dar'ya, the operating conditions, and low salt concentrations in the summer. In the first years of its operation, some sections of the canal were strongly overgrown. Now, however, 15 years later, submerged vegetation is sparse because of the high turbidity. The presence of reed thickets in the canal has improved water quality both directly as biofilters and indirectly by anchoring the banks. In predicting the development of macrophytes and algae in the canal the tendency toward eutrophication of the canal as a whole must be considered, along with the fact that in the near future clarified water will enter the canal. (Baker-FRC)
W83-02625

5

COME HELL AND HIGH WATER: MT. ST. HELENS AND THE FEDERAL RESPONSE ON THE LOWER COWLITZ RIVER,
Central Washington Univ., Ellensburg. Dept. of History.
G. H. Warren, D. E. Kaufman, and K. A. Hammond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191791, Price codes: A12 in paper copy, A01 in microfiche. Completion Report, December 1982. 213 p, 28 Fig, 110 Ref, 8 Append. OWRT C-10130-V(1476)(1), OWRT 14-34-0001-1476.

Descriptors: *Economic aspects, *Environmental effects, *Flood control, *Historic floods, *Social impact, *Volcanoes, Agriculture, Dredge spoil, Ecological effects, Economic development, Flood frequency, Rivers, Social adjustment, Social costs, *Washington, *Cowlitz River, *History, Mt. St. Helens.

Pioneers relied on the Cowlitz River for transportation but 20th Century residents value it for irrigation, recreation, and industrial uses. The federal government early assumed responsibility for channel maintenance, then flood control, and is now involved in both efforts. Periodic floods have not had long-term economic effects but temporarily slowed retail sales and construction. The 1980 Mt. St. Helens eruption is a continuing disaster which caused severe short-term damages and might have long-term economic and psychological impacts. Questionnaires were mailed in February, 1982, to 192 property owners who participated in the lower Cowlitz River restorative program, and a 20% sampling of those who responded were telephoned in a follow-up survey in July, 1982. Over 60% of the property owners lived elsewhere, believed they were the primary benefactors of the dredging operation, and welcomed additional spoils. Residents were most concerned about the spoils' infertility and the loss of recreation on the river. Field observations, information from governmental agencies, and interviews lead to the conclusions that: (1) the mudflow and spoils have low agricultural potential; (2) some owners reaped windfall benefits from the dredging program; and (3) some form of program to protect the area from future flooding will be demanded and will involve structures rather than social adjustments.
W83-02724

PLANT-SUBSTRATE INTERACTIONS AND BELOW SUBSTRATE BIOMAS DYNAMICS: A CONTINUATION OF STUDIES CONCERNING POTENTIAL RESTRICTION OF THE INTRODUCED AQUATIC WEED MYRIOPHYLLUM , SPICATUM L. (EURASIAN WATER MILFOIL),
Tennessee Univ., Knoxville. Dept. of Ecology.
For primary bibliographic entry see Field 2I.
W83-02729

4B. Groundwater Management

SYMPOSIUM ON SURFACE COAL MINING AND RECLAMATION IN THE NORTHERN GREAT PLAINS, AN UPDATE ON MINE SPOILS HYDROLOGY SOUTHEASTERN MONTANA,
Montana Bureau of Mines and Geology, Butte.
For primary bibliographic entry see Field 2F.
W83-02495

DISTURBANCE OF WATER PURIFICATION PROCESS BY ALGAE, ESPECIALLY DURING THE INFILTRATION OF A BIOLOGICALLY ACTIVE SURFACE WATER (BEEINTRACHTIGUNG DER WASSERREINIGUNG, INSBESONDERE BEI DER INFILTRATION EINES BIOLOGISCH HOCHAKTIVEN OBERFLACHENWASSERS),
Dortmunder Stadtwerke A.G. (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W83-02717

PRELIMINARY ASSESSMENT OF GROUND WATER MANAGEMENT ALTERNATIVES FOR IDAHO,
Idaho Univ., Moscow. Coll. of Mines and Earth Resources.
D. R. Ralston, S. duPont, and K. Hampton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191817, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, December 1982. 38 p, 9 Fig, 2 Tab, 8 Ref. OWRT A-078-IDA(1), 14-34-0001-0216.

Descriptors: *Groundwater management, *Groundwater mining, Groundwater budget, Groundwater depletion, *Idaho, *Alternative planning, Pumping rates, *Groundwater depletion, Recharge.

Many if not most of Idaho's ground water basins may be presently pumped at rates that exceed natural recharge. The general objective of this project is to provide a preliminary assessment of alternative management schemes for problems of overdraft of ground water basins. Four study basins were selected to represent the range of ground water development problems and the various stages of present resource management. Ground water development in the Moscow Basin has resulted in a steady rate of water level decline in what is likely a 'mining' situation. Local areas of water level decline have resulted from recent development of ground water in the Mountain Home area. A portion of this area is the Camas Praire area as a result of changing from dry land to irrigated agriculture. The Raft River Basin was declared critical in 1963. Management factors have been divided into three groups: hydrologic, development and legal guidelines. A basin classification system has been presented as a first step in a statewide management program. The classification system includes four factors reflecting management factors.
W83-02726

FEASIBILITY OF INCREASING WATER SUPPLIES AND PREVENTING ENVIRONMENTAL DAMAGE BY ARTIFICIAL RECHARGE IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
For primary bibliographic entry see Field 3B.
W83-02728

4C. Effects On Water Of Man's Non-Water Activities

SEDCON: A MODEL OF NUTRIENT AND HEAVY METAL LOSSES IN SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 2J.
W83-02734

4D. Watershed Protection

MASS BANK FAILURE ANALYSIS OF SELECTED YAZOO BASIN STREAMS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
W. C. Little, C. R. Thorne, and J. B. Murphey.
Transactions of the ASAE, Vol 25, No 5, p 1321-1328, September/October, 1982. 7 Fig, 4 Tab, 20 Ref.

Descriptors: *Streams, *Erosion control, *Banks, Channels, Erosion, Flow, Alluvial deposits, Borehole Shear Tester, Soil properties, Soil strength, *Yazoo Basin, River basins, *Mississippi.

The Iowa Borehole Shear Tester was used to measure in situ soil strength properties of loess-derived alluvial deposits. A simple stability analysis procedure and the measured soil properties were used to determine stable bank height and angle for the given soil properties for streams in the bluffline area of the Yazoo basin. Worst case conditions representing prolonged wet periods were a good predictor of critical bank height and angle. Calculated critical bank heights for the given bank angle, using the worst case conditions, agreed closely with observed bank heights and angles. Mean conditions, representing dry conditions during the summer, were an extremely poor predictor of instability. Structural toe revetments should be the most effective remedy for mass bank failures, since the revetment would decrease both the height and angle of bank and also prevent erosion of the bank toe. Results show the great importance of the control of bank height through control of channel bed degradation. The analysis may be used to aid in determining the location and invert elevation of channel grade control structures and the placement of toe revetment. (Baker-FRC)
W83-02453

MODELING SEDIMENT DEPOSITION BEHIND CORN RESIDUE,
Iowa Cooperative Extension Service, Cedar Rapids.
L. G. Brenneman, and J. M. Laflen.
Transactions of the ASAE, Vol 25, No 5, p 1245-1250, September/October, 1982. 9 Fig, 2 Tab, 17 Ref.

Descriptors: *Erosion control, *Model studies, *Slopes, Vegetation, Crops, *Corn, Rainfall, Sedimentation, Erosion, Watershed protection.

A simulation model was developed to predict the amount of sediment deposited behind corn residue in row middle areas. Data generated in a rainfall simulator field study were used for model validation. Observed soil erosion rates compared favorably with erosion rates predicted by the model. The results generated by the simulation model indicate that, although differences in soils can change crop residues' effect on soil losses, more influence is exerted by differences in slope steepness. As slope steepness increased crop residues were less effective in controlling soil erosion. (Baker-FRC)
W83-02455

GULLY CONTROL: DETERMINING TREATMENT PRIORITIES FOR GULLIES IN A NETWORK,
B. H. Heede.
Environmental Management, Vol 6, No 5, p 441-451, September, 1982. 10 Fig, 4 Tab, 10 Ref.

Descriptors: *Gullies, *Planning, *Erosion control, Erosion, Management, Watershed management, Design criteria.

A newly developed procedure for setting priorities in gully control is described. Basic gully systems and developments are explained as they are influenced by geomorphologic processes on which the proposed procedure is based. These processes con-

sist of two types; one representing interactions between the individual gullies of a network and the other, mechanisms initiated within a given gully by localized instability conditions. Classifying gullies into continuous and discontinuous types not only allows determination of network types but also points to critical locations that must be considered by the designer. The procedure consists of five steps: determining type of network based on gully types; stream ordering of the network gullies; tallying tributaries of each gully; analyzing stage of development of each gully; and ranking of treatment priorities. This technique establishes priorities that depend on opportunities to exert the greatest control for the least cost and to prevent the greatest amount of future erosion. (Baker-FRC)
W83-02544

SEDIMENT DEPOSITION IN A FLOOD-RETENTION STRUCTURE AFTER TWO RECORD FLOODS IN SOUTHWESTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
P. A. Kammerer, and W. G. Batten.
Journal of Soil and Water Conservation, Vol 37, No 5, p 302-304, September/October, 1982. 5 Fig, 1 Tab, 4 Ref.

Descriptors: *Sediment transport, *Floods, *Wisconsin, Sedimentation, Flood control, Erosion, Erosion control, Drainage basins, Driftless Area, Floodwater retention, Surface runoff.

Sediment deposited in a flood-control structure was measured after record floods in southwestern Wisconsin on June 17 and June 30-July 1, 1978. The structure is in the Driftless Area, where high relief, erodible soils, and land use contribute to high soil losses. The two floods deposited 4.1 acre-feet of sediment in the structure. This translates into a sediment yield of 3,200 tons per square mile from the 2.3 square mile drainage basin. Comparison of this yield to the average annual sediment yield of 13 tons per square mile between 1968 and 1974 illustrates the importance of isolated hydrologic events in determining sediment yields in the Driftless Area. (Baker-FRC)
W83-02705

MODIFIED RUNOFF CURVE NUMBERS FOR SUGARCANE AND PINEAPPLE FIELDS IN HAWAII,
Agricultural Research Service, Boise, ID. Northwest Watershed Research Center.
For primary bibliographic entry see Field 2A.
W83-02706

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

SEDIMENTARY CHARACTERISTICS OF SUSPENSIONS IN LONDON STORMWATER,
Middlesex Polytechnic, London (England).
J. B. Ellis, R. Hamilton, and A. H. Roberts.
Sedimentary Geology, Vol 33, No 2, p 147-154, 1982. 3 Fig, 17 Ref.

Descriptors: *Sediments, *Storm water, *Urban runoff, Suspended sediments, Storm runoff, London, *United Kingdom, Runoff, Particle size, Chemical composition, *Pollutant identification.

The size and composition of suspended solids in urban runoff were studied during 3 storm events in a 420 ha section of London. The particle size distribution (1-60 microns), suspended solids concentrations (maximum 262 mg per liter) rainfall intensity, and antecedent conditions varied widely among the storms. The particle size distribution showed strong bimodality (peaks at 2 and 20 microns) in the 2 summer storms. Smaller particles were dominant in the rising limb of the hydrograph because of flushing from the storm drain system early in the storm. In the third storm the unimodal distribution indicated flocculated or aggregated suspensions, which was confirmed by microscopic studies. Storm water sediments consisted of inorganic grains, organic matter, bacterial slimes, and other particles. Most particles were aggregated. Finer inorganic sediment fractions were dominated by quartz and feldspar, with smaller amounts of mica and chlorite. Little or no clay minerals were present. Chemically, the most common elements were Si and Al, followed by K, Fe, and Ca. Small amounts of Mg, S, Cl, P, and Ti were consistently found. This composition was typical of road dusts. Coarse sediments were rapidly transported through the system, as evidenced by the unaltered physical and chemical natures. (Cassar-FRC)
W83-02451

DETECTION OF POTENTIAL CARCINOGENS AND TOXICANTS IN TAP AND RECLAIMED WATER BY THE GOLDEN HAMSTER CELL TRANSFORMATION ASSAY,
National Inst. for Water Research, Pretoria (South Africa).
R. Kfir, and O. W. Prozesky.
Water Research, Vol 16, No 12, p 1561-1568, December, 1982. 4 Fig, 3 Tab, 35 Ref.

Descriptors: *Carcinogens, *Reclaimed water, *Secondary wastewater treatment, Pollutant identification, Toxicity, Water analysis, Wastewater treatment, Fate of pollutants, Water treatment, Transformation assay, Hamster cells, Bioassays.

A transformation assay using primary golden hamster embryonic cells was used to detect carcinogens in samples of Stander reclamation plant influent, effluent, and process streams. The average percentages of transformation of various water samples were: influent, 0.80%; effluent, 0.16%; and tap water, 0.36%. Transformation percentages in intermediate process steps showed a gradual reduction except in three instances. Toxocity was also reduced by the reclamation process: influent, 58% survival of cells, and effluent, 76% survival of cells. Variations in water quality parameters were not correlated with changes in transformations or toxicity levels. This method required no concentration or extraction procedures. (Cassar-FRC)
W83-02460

PESTICIDES IN LOWER FLATHEAD VALLEY DRAINAGE,
Montana Univ., Missoula. Dept. of Environmental Studies.
R. E. Erickson, and M. G. Essig.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186494, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Report No 123, Montana State Univ., Bozeman, September 1981. 23 p, 1 Fig, 2 Tab, 4 Ref, 1 Append. OWRT A-121-MONT(1), 14-34-0001-0128, 14-34-0001-1128.

Descriptors: Baseline studies, Water quality, *Pesticide residue, Gas chromatography, *Pollutant identification, Sampling, Pesticides, Water analysis, Instrumentation, Lower flathead drainage, *Montana.

Samples of stream water from six sites in the lower Flathead River drainage were analyzed for selected pesticides (2,4D, 2,4D methyl ester, xylenes, diazinon, endosulfan, monitor, banvel, and perthane) over an eleven-month period in 1980. None of the sampling sites showed any trace of any of the target pesticides on any of the 14 sampling days of the study. (Detection limits were between .04 and .25 ppm for all pesticides except xylenes, whose detection limit was 5 ppm). Although the study was beset with instrument problems from its inception, a cross-check of a randomly selected set of samples using a more reliable gas chromatorgraph with a flame ionization detector validated these results.
W83-02496

ISOLATION OF HYDROCARBON RESIDUES FROM SEDIMENT BY STEAM DISTILLATION,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
A. A. Belisle, and M. L. Gay.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 5, p 539-543, November, 1982. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Separation techniques, *Hydrocarbons, *Stream pollution, *Bottom sediments, Oil, *Pollutant identification, Cleanup, Gas chromatography, Mass spectrometry, Pennsylvania, *Steam distillation method.

A quick and efficient cleanup procedure utilizing steam distillation was developed for the isolation of hydrocarbons in wet sediments before residue analysis by gas chromatography-mass spectrometry. The method involves extraction and cleanup of sediment in a modified Nielson-Kryger steam distillation apparatus for 2 hr. The procedure was tested on sediment samples from a western Pennsylvania stream, which were spiked at levels of 0.04 and 4.0 parts per million (ppm) with each of 14 aliphatic and 9 aromatic petroleum hydrocarbons known to accumulate in animal tissue. The absolute detection limit was about 0.50 nanograms for all compounds, and recoveries of the reference hydrocarbons ranged from 33 to 100% when spiked at 0.04 ppm and from 72 to 93% at 4.0 ppm. Results indicate that steam distillation offers a relatively simple and efficient method for extraction of aliphatic and aromatic hydrocarbons in wet sediment. (Geiger-FRC)
W83-02514

THE OCCURRENCE OF PCH3-CONTAINING COMPOUNDS IN SURFACE WATERS,
Prins Maurits Lab. TNO, Rijswijk (Netherlands). Inst. voor Chemische en Technologische Research.
A. Verweij, G. F. Mensingh, and H. L. Boter.
Chemosphere, Vol 11, No 10, p 985-990, 1982. 5 Tab, 3 Ref.

Descriptors: *Surface waters, *Water pollution sources, *Organic compounds, Industrial wastes, Wastewater, Pollutants, Methylphosphonates, Fate of pollutants, *PCH3 compounds, Pollutant identification.

The concentration of PCH3 (methylphosphonate)-containing compounds was determined in several surface water samples obtained from a number of Western European countries and in North America. A correlation was found between the concentration and the degree of water pollution. This correlation suggests that the presence of PCH3-containing compounds in water is due to industrial sources of water pollutants. The samples were easily divided into four distinct groups: very clean, clean, industrially polluted, and wastewater, according to the grades of pollution as indicated by the sampling authorities. The results confirm the previously suggested possibility of methylphosphonic acid accumulation in the environment. (Baker-FRC)
W83-02518

THE EPA-TEST – A METHOD FOR THE DETERMINATION OF PHOTOCHEMICAL DEGRADATION OF ORGANIC COMPOUNDS IN AQUATIC SYSTEMS (DER EPA-TEST--EINE METHODE ZUR BESTIMMUNG DES PHOTOCHEMISCHEN ABBAUS VON ORGANISCHEN VERBINDUNGEN IN AQUATISCHEN SYTEMEN),
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Freising-Weihenstephan (Germany, F.R.).
K. Hustert, M. Mansour, H. Parlar, and F. Korte.
Chemosphere, Vol 10, No 9, p 995-998, September, 1981. 2 Tab, 3 Ref. (No English Summary).

Descriptors: *Pollutant identification, *Degradation, *Solar radiation, *Organic compounds, *Water analysis, Mathematical equations, Laboratories, Testing procedures, *Photochemical degradation, Methanol, Benzene, Hexachlorobenzene, p-Nitrophenol, Hydrogen ion concentration, Geography, Seasonal variation, Weather, Carbon tetrachloride, Fate of pollutants.

A collaborative study conducted by the OECD Chemical Testing Program to test a method of analyzing the degradation of environmental chemicals in aquatic systems under the influence of sunlight is described. Five compounds were tested: methanol, carbon tetrachloride, benzene, hexachlorobenzene, and p-nitrophenol. The compounds were dissolved in water at controlled concentrations in glass test tubes, which were placed in sunlight for specified periods. Equations to calculate the rate constant and half-time of biological degradation comprised the method to be tested. No reduction in concentration due to radiation was noted for hexachlorobenzene, carbon tetrachloride, or methanol, which is understandable, as they do not absorb in the 290 nm wavelength region. Experiments with quartz glass test tubes were also negative. The longest half time was recorded for benzene (16.9 days). Since p-nitrophenol is a weak acid, half-times were dependent on the pH of the solution. Weather conditions changed in the course of the experiment, and since no actinometer was used, results can only be compared with reservation. The half-times for all substances except p-nitrophenol showed an extremely wide spread; possible causes were high volatility variable radiation intensity, or unsuitable testing methods. Results showed that the method is not suitable for all substances. Problems occurred with low water solubility and high vapor pressure. Another precondition is absorption in the 290 nm wavelength region. An actinometer should be used to monitor radiation intensity, or control substances should be employed. Standard methods of analysis are recommended for collaborative studies. Under these conditions, the EPA method is acceptable. (Gish-FRC)
W83-02519

PERSISTENT ORGANIC CHEMICALS IN SEWAGE EFFLUENTS. 2. QUANTITATIVE DETERMINATIONS OF NONYLPHENOLS AND NONYLPHENOL ETHOXYLATES BY GLASS CAPILLARY GAS CHROMATOGRAPHY,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
E. Stephanou, and W. Giger.
Environmental Science and Technology, Vol 16, No 11, p 800-805, November, 1982. 3 Fig, 3 Tab, 20 Ref.

Descriptors: *Surfactants, *Phenols, *Nonyl phenols, *Pollutant identification, Detergents, Nonionic Surfactants, Toxicity, Alkyl phenols, Organic compounds, Wastewater analysis, Path of pollutants, Gas chromatography.

Nonylphenols (NP) and nonylphenol ethoxylates with 1 and 2 oxethylene groups (NP1 and NP2) were quantitatively determined in effluents from six secondary sewage plant effluents in the Zurich, Switzerland, area. These substances, highly toxic to aquatic organisms, are refractory metabolites of the nonylphenol polyethoxylate nonionic surfactants. Nonylphenol and derivatives were not detected (limit, < 10 micrograms per liter) in effluents from three of the plants, all of which operated under low loading conditions. In the other effluents the concentrations (micrograms per liter) were: NP, non-detectable to 35; NP1, 24-133; and NP2, non-detectable to 70; totals, 36-202 or 0.5%-2.3% of total residual dissolved organic carbon. (Cassar-FRC)
W83-02529

PROTAMINE PRECIPITATION OF TWO REOVIRUS PARTICLE TYPES FROM POLLUTED WATERS,
Dugway Proving Ground, UT. Environmental and Life Science Div.
D. J. Adams, D. N. Ridinger, R. S. Spendlove, and B. B. Barnett.
Applied and Environmental Microbiology, Vol 44, No 3, p 589-596, September, 1982. 1 Fig, 5 Tab, 18 Ref.

Descriptors: *Viruses, *Water analysis, *Water pollution, Human diseases, Public health, Pollutant identification, Wastewater.

Two forms of virus particle are released from reovirus-infected cell cultures, infectious reovirus and potentially infectious reovirus (PIV). PIV particles forms have a complete outer coat and are not infectious until the outer coat is changed or removed. The PIV concentration in polluted waters, however, has not been determined. Protamine sulfate precipitation, using 0.25% fetal bovine serum and 0.005% protamine sulfate for the first precipitation of the sample and 0.0025% for the second, was employed to concentrate infectious reovirus and PIV from water and sewage. Infectious reovirus and PIV particles were concentrated over 500-fold from river water inoculated with virus, and virus recoveries of between 80 and 100% were achieved. Virus precipitates stored at -20C as a protamine-virus concentrate showed a 5% loss of PIV after 14 days. Virus preparations were assayed, before and after treatment, with 200 micrograms of chymotrypsin per ml, using a fluorescent-antibody procedure. Protamine sulfate precipitation and fluorescent-antibody detection are effective ways to recover and assay reoviruses present in raw sewage. (Baker-FRC)
W83-02555

THE ECOLOGICAL CLASSIFICATION OF THE QUALITY OF SURFACE WATERS ON LAND, PRINCIPLES AND PRACTICAL EXPERIENCE,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5C.
W83-02569

PRACTICAL DETERMINATION OF THE FIRST STAGE BOD OF SEWAGE,
T. Stones.
Effluent and Water Treatment Journal, Vol 22, No 10, p 391-394, October, 1982. 1 Fig, 2 Tab, 6 Ref.

Descriptors: *Biochemical oxygen demand, *Wastewater oxidation, *Oxidation, *Wastewater treatment, Dissolved oxygen, Oxygen, Domestic wastewater, Wastewater analysis, Kinetics.

A relationship for determining first stage (carbonaceous) biochemical oxidation of a 1/100 dilution of settled domestic sewage at 20C was prepared from experimental results. The first stage BOD = dx/dt x 1/k(a - x) + x, where k = velocity coefficient (0.039 for domestic sewage), a = initial dissolved oxygen concentration, and x = amount of dissolved oxygen absorbed. On the average, the amount of dissolved oxygen absorbed in 5 days was about 75% of the first stage BOD. (Cassar-FRC)
W83-02581

OPTIMIZATION STUDIES FOR RELIABLE TRACE METAL ANALYSIS IN SEDIMENTS BY ATOMIC ABSORPTION SPECTROMETRIC METHODS,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
R. Breder.
Fresenius Zeitschrift fuer Analytische Chemie, Vol 313, No 5, p 395-402, 1982. 5 Fig, 13 Tab, 27 Ref.

Descriptors: *Pollutant identification, *Atomic absorption spectrophotometry, *Analysis of variance, *Sediments, *Trace metals, *Precision, Metals, Separation techniques, Decomposition, Mathematical studies, Lake sediments, Marine sediments, Fluvial sediments, Standard deviation, *Federal Republic of Germany.

Sediments may act as permanent or temporary traps for metals introduced into the aquatic environment. Studies were performed on the total metal contents of sediment samples taken from rivers, lakes, estuaries, and coastal zones. The sediments were decomposed under pressure with a 3:1 mixture of nitric acid/hydrochloric acid and analyzed by atomic absorption spectrometry in appropriate specific modes (flame, graphite, furnace, cold vapor mode, hydride system). The methods were optimized and verified with regard to precision and accuracy for the determination of 12 metals (Ag, As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Se, and Zn) or metalloids with the help of some new representative Standard Reference and Control Materials. (Geiger-FRC)
W83-02609

EXTRACTIVE SPECTROPHOTOMETRIC DETERMINATION OF NITRATE IN POLLUTED WATERS,
Ravishankar Univ., Raipur (India). Dept. of Chemistry.
A. Chaube, A. K. Baveja, and V. K. Gupta.
Analytica Chimica Acta, Vol 143, p 273-276, 1982. 3 Tab, 11 Ref.

Descriptors: *Pollutant identification, *Spectrophotometry, *Nitrites, *Separation techniques, *Dyes, Water analysis, Absorption, Sensitivity analysis, Industrial wastes, Nitrogen compounds, Rivers.

A highly sensitive method was developed for the extractive spectrophotometric determination of nitrate at the parts per billion (ppb) level using p-nitroaniline as diazotization reagent and 8-quinolinol as coupling reagent. Nitrite in water samples is diazotized with p-mitroaniline in hydrochloric acid and coupled with 8-quinolinol in alkaline medium to give a purple azo dye. Extraction of the dye into 3-methyl-1-butanol shifts the absorption maximum to 570 nanometers, thus improving the apparent molar absorptivity to .0005852 liters/mole/cm while masking the effects of interfering ions. The Sandell sensitivity of the method is 0.00078 micrograms/sq cm, and Beer's law is obeyed for 0.01-0.06 ppm nitrite. The method was successfully applied to analysis of nitrite in polluted river water samples and proved more selective than conventional sulfanilamide-N(1-naphthyl)-ethylenediamine dihydrochloride methods of nitrate determination. (Geiger-FRC)
W83-02635

THE DETERMINATION OF LEAD IN TAP-WATER BY RESIN PRECONCENTRATION FOLLOWED BY FLAME ATOMIC ABSORPTION SPECTROMETRY,
Edinburgh Univ. (Scotland). Dept. of Chemistry.
A. G. Rowley, I. A. Law, and F. M. Husband.
Analytica Chimica Acta, Vol 143, p 265-268, 1982. 5 Ref.

Descriptors: *Lead, *Separation techniques, *Atomic absorption spectrophotometry, *Resins, *Polymers, Potable water, Adsorption, *Pollutant identification, Water analysis, Sample preparation.

A simple and economical method for the preconcentration of lead from tapwater based on a resin of polystyrene-supported poly(maleic anhydride) was developed. The preconcentration sample is analyzed by flame atomic absorption spectrometry at 217 nm. The resin is prepared by initiating the polymerization of maleic anhydride by polystyryl(ethylpyridine) under nitrogen at 120 degrees for 5 hr. The resin beads are held by glass wool in a vertical tube of flexible polyvinyl chloride, 8 mm internal diameter. Adsorption of lead from a one-liter tap water specimen passing through 1 g of resin under natural gravity flow in 1 hr was quantitative. Dilute (2 molar) nitric acid serves as eluant. The method was found to be accepatable for the determination of lead at levels well below the 50 nanogram/cu cm limit proposed by the Council of European Communities. (Geiger-FRC)
W83-02636

THE POTENTIOMETRIC TITRATION OF SULFIDE IN WASTEWATER USING A SENSITIVE ELECTRODE (DIE POTENTIOMETRISCHE TITRATION VON SULFID IN ABWASSER MIT HILFE EINER SENSITIVEN ELEKTRODE),
VEB Wasserversorgung und Abwasserbehandlung, Dresden (German D.R.).
G. Sbieschni.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 1, p 101-105, 1980. 2 Fig, 8 Ref. (No English Summary).

Descriptors: *Sulfides, Wastewaters, *Potentiometers, *Pollutant identification, *Electrodes, Water analysis, Ions, Sensitive electrodes, *Titration, Water quality, Water pollution.

A method is described for the potentiometric precipitation titration of sulfide in wastewater using a sensitive electrode. The electrode consists of a sensor membrane screwed, glued, or pressed into an electrode shaft. The membrane is made of material that is conductive at room temperature, that has low solubility, and that is highly chemically and mechanically stable. The potential difference on the electrode surface arises from a grid defect mechanism: because the empty spots on the grid can only be occupied by ions of a similar size, the reaction is very specific. The measured electromotive force is dependent upon the activity of the test ion on the basis of Nernst's equation. For every power of ten change in activity, the potential of a univalent ion at a constant temperature changes by 0.058 volts. For wastewaters of varying composition, measurement of a uniform starting potential cannot be assumed. The multiplicity of interference moments means that Nernst's equation is only applicable without reservation when pure sulfide solutions are used. As a titrant, 0.01 N or 0.1 N AgN03 is used. The measuring equipment consists of a sensitive Ag/S electrode, a calomel electrode, an agitator, and a beaker as titration vessel. When the method was used for numerous wastewater samples from dye factories, overloaded treatment plants, and meat- and milk-processing concerns, it proved to be reliable and fast. The standard deviation (SD) for 0.55 mg sulfide was 0.06 mg (10%) and the confidence level (CL) was 0.04 mg (7%); 5.5 mg sulfide the SD was 0.31 mg (6%) and the CL 0.22 mg (4%). Iodometric sulfide determination for approximately the same concentrations had an SD of about 18% and a CL of about 12%. The method is not recommended for sulfide quantities < 0.2 mg. (Gish-FRC)
W83-02639

PRECONCENTRATION METHODS FOR THE ANALYSIS OF WATER BY X-RAY SPECTROMETRIC TECHNIQUES,
Antwerp Univ., Wilrijk (Belgium). Dept. of Chemistry.
R. Van Grieken.
Analytica Chimica Acta, Vol 143, p 3-34, 1982. 2 Fig, 2 Tab, 178 Ref.

Descriptors: *Literature reviews, *X-ray spectroscopy, *Separation techniques, *Water analysis, *Ion exchange, Reviews, *Spectroscopy, *Pollutant identification, Evaporation, Chemical precipitation, Chelation.

All the published procedures for multi-element preconcentration of trace elements prior to X-ray fluorescence analysis of water are reviewed and critically evaluated. Most of the preconcentration methods used in the determination of single elements in water are also listed. The 120 multi-element methods are categorized as evaporation techniques, ion exchangers, ion-collecting filters, precipitation and coprecipitation procedures, liquid-liquid extraction techniques, chelation and subsequent sorption immobilization methods, and electrodeposition procedures. Of the 43 single-element preconcentration procedures, 6 are concerned with the determination of uranium, 9 are for halide anions, 5 are for sulfur and sulfate anions, 3 are for chromium, and one method each is given for potassium, phosphorus, iron, nickel, arsenic, molybdenum, barium and mercury. Selection of a preconcentration procedure before X-ray fluorescence analysis depends on the type and variability of samples, the number and concentration of elements to be assayed, and the relative emphases placed on speed, quality and cost of the analysis. (Geiger-FRC)
W83-02654

A COMPARISON OF WATER SOLUBILITIES BY THE FLASK AND MICRO-COLUMN METHODS,
Keio Univ., Yokohama (Japan). Dept. of Applied Chemistry.
Y. Hashimoto, K. Tokura, K. Ozaki, and W. M. J. Strachan.
Chemosphere, Vol 11, No 10, p 991-1001, 1982. 1 Fig, 3 Tab, 10 Ref.

Descriptors: *Water analysis, *Solubility, Physical properties, Measuring instruments, Testing procedures, *Pollutant identification, *Organic compounds, Adsorption.

Ascertaining the water solubility of potential or known pollutants is an important factor in estimating their soil adsorption coefficients or bioconcentrations, and therefore in predicting their environmental fate and the likelihood of adverse effects in fish. The OECD 'Test Guideline: Water Solubility' recommends the microcolumn method for the solubility range of 10 mg/liter to 10 microg/liter. This method requires repeated concentration determinations to ensure that solution equilibrium has been achieved by passing water at a moderate rate through a small column packed with glass beads coated with the test compound, a tedious procedure. The flask method, commonly applied for more soluble compounds, was modified to cover compounds with solubilities of less than 10 mg/l using only two determinations, a preliminary and a final measurement. The solute to be tested was coated onto glass beads from an acetone solution; the mixture was agitated for 24 hr at 20C, equilibrated for an additional 48 hr at the same temperature, then filtered by suction and analyzed. Of the four filter types examined, the cellulose ester membrane filter adsorbed significant quantities of tested solutes, while the 0.3-0.7 micron glass fiber filters performed satisfactorily. (Baker-FRC)
W83-02670

DETERMINATION OF EDTA IN WATER BY HIGH-PERFOMANCE LIQUID CHROMATOGRAPHY,
Institute for Land and Water Management Research, Wageningen (Netherlands).
J. Harmsen, and A. Van Den Toorn.
Journal of Chromatography, Vol 249, No 2, p 379-384, 1982. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Pollutant identification, *High performance liquid chromatography, *Gas chromatography, *Iron, *Metal complexes, *EDTA, Separation techniques, Water analysis, Industrial wastewater, Domestic wastes, Farm wastes, Heavy metals, Membrane filters, Chelating agents.

A high performance liquid chromatography (HPLC) method was developed for the determination of ethylenediaminetetraacetic acid (EDTA) in water. A solution of sodium chloride and glacial acetic acid served as eluant, and the samples were passed over a 0.45 micron membrane filter to prevent clogging of the chromatographic system. Prepared samples were kept in the dark until injection to prevent photochemical degradation of the EDTA. Iron (III) reagent in glacial acetic acid was also added to the sample to allow an adsorption maximum at a higher wavelength due to the iron(III)-EDTA complex. The method was linear in the range of 0-50 milligrams/liter in which EDTA may occur in polluted water samples. The addition of other heavy metals except for Co did not interfere with results. The detection limit was about 0.2 milligrams/liter. Comparisons of the HPLC method and a gas chromatographic (GLC) method for the determination of EDTA in groundwater samples showed that the HPLC method systematically gave results 13% higher than the GLC method due to the high iron content of the samples. In such cases, the HPLC method would be more realible than the GLC technique. It was also noted that sodium nitrate could be substitued for sodium chloride as eluant in the HPLC procedure. (Gieger-FRC)
W83-02676

MEASURING CHLORINE DIOXIDE WITH A ROTATING VOLTAMMETRIC MEMBRANE ELECTRODE.
West Virginia Univ., Morgantown. Dept. of Chemistry.
R. B. Smart, and J. W. Freese.
Journal of the American Water Works Association, Vol 74, No 10, p 530-531, October, 1982. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Chlorine dioxide, *Wastewater analysis, *Water analysis, Electrodes, Voltammetry, Monitoring, Automation, *Pollutant identification.

Chlorine dioxide in water and wastewater was detected at low concentrtions (less than 1 mg per liter) with a new rotating voltammetric membrane electrode. This detector is suitable for continuous automated monitoring. There are no interferences from hypochlorite, chlorite, chlorate, chromate, permanganate, ferric ion, or turbidity. At a chlorine dioxide concentration of 0.30 mg per liter the relative standard deviation was 6.4%. Results using the voltammetric membrane electrode compared well with the chlorophenol red method. The iodometric method gave higher results. (Cassar-FRC)
W83-02682

AQUEOUS ODOR AND TASTE THRESHOLD VALUES OF INDUSTRIAL CHEMICALS,
Dow Chemical Co., Midland, MI.
H. C. Alexander, W. M. McCarty, E. A. Bartlett, and A. N. Syverud.
Journal of the American Water Works Association, Vol 74, No 11, p 959-599, November, 1982. 4 Tab, 14 Ref.

Descriptors: Data collections, *Organoleptic properties, *Industrial chemicals, *Taste, *Odor, Industrial wastes, Spills, Water pollution effects, Water pollution sources, *Pollutant identification.

A study was conducted to generate odor and taste data for use in responding to emergencies in which a chemical has been spilled into public waters during its transport or storage. Data have been generated on odor thresholds for 63 industrial chemicals. Forty-six of these have also been evaluated for taste threshold. A triangle evalution procedure was used for the evaluation. A standard odor calibrating substance, 1-butanol, was used to compare these values with those reported in the literature. The sensitivity of the panel members to the standard was greater than that reported in the literature. Although threshold values were determined with water at 60 degrees C, these values should be applicable at ambient temperatures. The temperature effect appeared to be small. The lowest odor threshold value noted was 0.0008 mg/liter for number 2 fuel oil. Naphtha had the lowest taste threshold value, 0.02 mg/liter. (Baker-FRC)
W83-02684

DETERMINATION OF RADIUM-228 IN FOODS AND WATER,
Food and Drug Administration, Winchester, MA. Winchester Engineering and Analytical Center.
E. J. Baratta, and E. M. Lumsden.
Journal of the Association of Official Analytical Chemists, Vol 65, No 6, p 1424-1428, 1982. 2 Tab, 13 Ref.

Descriptors: *Pollutant identification, *Radium radioisotopes, *Water analysis, *Separation techniques, *Ion exchange, *Actinium, Radioisotoes, Radioactivity, Anion exchange, Cation exchange, Foods.

A method was developed for the rapid determination of radium (Ra 228) in foods and water by measuring its decay product actinium (Ac 228), which reaches a known secular equilibrium stage with a 6.1 hr half-life. Food samples can be prepared by wet- or dry-ashing techniques. The Ac 228 is precipitated from samples by a lanthanum carrier, dissolved, purified by solvent extraction, and decontaminated on anion and cation exchange resins. Radioactivity is measured in a thin-window, low level gas flow beta counter. Sample radioactivity may have to be counted several times to follow the half-life time of Ac 228 and ensure its purity. The method is sensitive to 1 pCi/sample of food ash and to 1 pCi/liter of wqter. To compensate for a counting error of 0.3 pCi/sample, the sample size for water may have to be increased to 4 liters. The decontamination factors are high for interfering radionuclides; the analysis does not require specialized equipment and may be performed fairly rapidly. (Geiger-FRC)
W83-02686

SIMPLE PAPER CHROMATOGRAPHIC METHOD FOR RAPID DETECTION OF CHROMATE (VI) IN FRESH WATER,

Sri Venkateswara Univ., Tirupati (India). Dept. of Zoology.
S. Rajendrababu, and N. V. N. Kumar.

Journal of the Association of Official Analytical Chemists, Vol 65, No 6, p 1375-1378, 1982. 2 Tab, 11 Ref.

Descriptors: *Pollutant identification, *Separation techniques, *Water analysis, *Paper chromatography, *Metals, Metal complexes, Chromatography, Potassium compounds, Industrial wastes, *Chromium, Dehydrogenase, *Potassium dichromate.

A simple method was devised for the concentration and detection of potassium dichromate directly in fresh water. Freshwater samples spiked with potassium dichromate were concentrated by evaporation in a petri dish. After addition of buffer, the concentrates were applied by microcapillary to Whatman No. 3 filter strips for paper chromatographic separation using different acetone:EDTA:water solvent systems. After air drying, the strips were sprayed with pig liver acetone powder enzyme suspension or freshly prepard sheep liver homogenate. The strips were then oven dried and sprayed with sodium succinate-INT-PMS-buffer mixture before redrying. Potassium dichromate chromatographically separated with acetone:water:EDTA (75:20:5) gave a compact chromatogram visualized as a white inhibition area of succinate dehydrogenase at Rf 0.75. The method can also be used for the detection of potassium dichromate in 0.01 N acidic or alkaline water which is typical of industrial effluents. Acidity exceeding 0.01 N is likely to interfere with detection, but this problem may be overcome by sample dilution. In a spot test version of the method where potassium dichromate is applied on paper, as little as 2 micrograms can be detected without chromatographic separation. The method receives no interference from other common metal compounds and has a detection limit of 5 micrograms on the paper chromatography strip. (Geiger-FRC)
W83-02687

PERFORMANCE VARIABILITY, RANKING, AND SELECTION ANALYSIS OF MEMBRANE FILTERS FOR ENUMERATING COLIFORM BACTERIA IN RIVER WATER,

Columbus Dept. of Public Service, OH. Div. of Water.
R. C. Lorenz, J. C. Hsu, and O. H. Tuovinen.

Journal of the American Water Works Association, Vol 74, No 8, p 429-437, August, 1982. 4 Fig, 8 Tab, 42 Ref.

Descriptors: *Membranes, *Filtration, *Coliforms, Rivers, *Statistical methods, Bacteria, Membrane processes, Analysis of variance, Statistical analysis, Feces, Water pollution, *Pollutant identification, Ohio, Columbus.

Seven different kinds of membrane filters were evaluated for the enumeration of fecal coliforms in water samples from three rivers. Analysis ofvariance of filter performance indicated significant interaction between the filter and river water. The ranking and selection of filters was performed by using two different statistical procedures. A newly developed statistical method - MCB (Multiple Comparisons with the Best)- was introduced. None of the filters examined was found to be perfectly suitable for enumeration of fecal coliforms or total coliforms. Based on relative merits, two filters were outstanding: Millipore HC and Puropore filters. (Author's abstract)
W83-02690

ISOLATION OF NEW TYPES OF SULPHATE-REDUCING BACTERIA FROM ESTUARINE AND MARINE SEDIMENTS USING CHEMOSTAT ENRICHMENTS,

Dundee Univ. (Scotland). Dept. of Biological Sciences.
S. M. Keith, R. A. Herbert, and C. G. Harfoot.

Journal of Applied Bacteriology, Vol 53, No 1, p 29-33, 1982. 1 Fig, 1 Tab, 14 Ref.

Descriptors: *Marine sediments, *Anaerobic bacteria, *Anaerobic conditions, *Culturing techniques, *Culture media, Estuaries, *Pollutant identification, Separation techniques, Agars, Growth media, Tay River estuary, *United Kingdom.

Anaerobic chemostat enrichments were developed which were successfully used for the isolation of acetate-utilizing, sulfate-reducing bacteria from sediments in the Tay estuary. Enrichments were performed in a single stage, 1-l chemostat under carbon limitation at a dilution rate of 0.035 hr. The chemostat and medium reservoir were flushed with 10 milliliters of oxygen-free nitrogen/min. A continuous culture medium developed by Postgate (1966) was used with sodium lactate as carbon source. After the sediments were introduced, samples were aseptically removed at 2-day intervals and were transferred to agar shake dilution tubes. Pure cultures were obtained by repeated passages through agar shakes. Substrate utilization tests were performed to confirm the presence of acetate-utilizing, sulfate-reducing bacteria and the absence of contaminants. Using this procedure, several different morphological types of sulfate-reducing bacteria could be isolated from Tay estuary sediments in a controlled and reproducible system at low growth rates. (Geiger-FRC)
W83-02700

THE ISOLATION OF BACTERIOPHAGES FROM THE ENVIRONMENT,

Searle and Co. Ltd., High Wycombe (England). Searle Research and Development.
N. D. Seeley, and S. B. Primrose.

Journal of Applied Bacteriology, Vol 53, No 1, p 1-17, 1982. 3 Fig, 1 Tab, 102 Ref.

Descriptors: *Adsorption, *Viruses, *Ultrafiltration, *Separation techniques, *Bacteriophage, *Literature review, *Pollutant identification, Filtration, Dehydration, Enteroviruses, Adsorbents, Reviews, Microbiological studies, Indicators, Wastewater, Coliphages.

A review is presented of the different methods available for concentrating bacteriophages from the environment. Some modifications that may be made to the methods and some of the applications of the methods are also discussed. Enrichment techniques through selective culture media continue to provide a useful biological means for phage isolation. Ultracentrifugation and sample dehydration are physical methods of concentrating phage from large volumes of water. Some physicochemical methods of concentrating phage include phage adsorption and microporous filtration by electronegative or membrane filters. For concentrating human viruses, dehydration, filtration and freeze concentration have been successfully employed. Protamine sulfate has been used as an adsorbent of viruses from sewage and treated sewage effluents. Vegetable extracts, glass powder, and talc and Celite mixtures can all adsorb enteroviruses from water. Various eluants for isolated viruses and reconcentrating materials are discussed. Ultrafiltration is used routinely for reconcentrating eluants. Chaotropic agents which destroy hydrophobic bonding between filters and viruses will become important as aids to virus concentration. Some theories on virus adsorption mechanisms are presented. Selection of a concentration technique will depend on what type of viruses need to be isolated, the medium they are to be isolated from, and its volume. Phages may be used as specific cell surface probes, in selecting cell surface mutants, as indicators of water quality and as tracers of water movement. (Geiger-FRC)
W83-02708

VOLATILE ORGANIC COMPOUNDS IN WATER AT THIRTY CANADIAN POTABLE WATER TREATMENT FACILITIES,

Health and Welfare Canada, Ottawa (Ontario). Health Protection Branch.
R. Otson, D. T. Williams, and P. D. Bothwell.

Journal of the Association of Official Analytical Chemists, Vol 65, No 6, p 1370-1374, 1982. 3 Tab, 17 Ref.

Descriptors: *Organic compounds, *Pollutant identification, *Separation techniques, *Water analysis, Raw water, *Potable water, Gas chromatography, Organic solvents, Seasonal variation, Organic wastes, Treated water, Chloroform, *Canada.

A survey was made of a broad spectrum of volatile organic compounds in raw and treated water at 30 Canadian potable water treatment facilities using a static headspace technique and a dynamic headspace and liquid-liquid extraction procedure. The static headspace technique involved the use of a Tenax gas chromatographic column and a gas-tight syringe and was used for the determination of some very volatile alkyl halides which could not be easily detected by the other extraction methods. Of the 43 compounds studied, 27 were present in water samples. Chloroform and bromodichloromethane were detected most frequently in treated water, while trichloroethylene, tetrachloroethylene, 1,2-dichloroethane, dichloromethane, benzene, toluene, ethylbenzene, and the xylenes occurred in both treated and raw water samples. Of the 43 compounds studied, 27 were present in water samples. Only chloroform occurred frequently at levels above 10 micrograms/liter in treated water. Concentrations of organic compounds were generally higher during August and September than they were in November and December. (Geiger-FRC)
W83-02715

TOXIC SUBSTANCES MONITORING PROGRAM - 1981,

California State Water Resources Control Board, Sacramento.
F. LaCaro, S. P. Hayes, D. Watkins, and C. Reiner.

Water Quality Monitoring Report No 82-3TS, December 1982. 54 p, 22 Fig, 11 Tab, 54 Ref, 5 Append.

Descriptors: *Toxicity, *Water quality data, *Water sampling, Pollutants, *Trace metals, Fish toxins, Organic compounds, *Pollutant identification, Aquatic animals, Aquatic plants, Fish populations, Mercury, DDT, Copper, *California, *Monitoring, Data collections.

Since 1977, this program has provided information annually on the statewide occurrence of toxic pollutants in aquatic biota, as well as an evaluation of trends or changes in pollutant levels to identify areas where action should be taken to reduce or eliminate pollution levels. In 1981, 22 species of predator and forage fish from 44 stations were analyzed for 10 trace metals and 66 synthetic organic substances. National Academy of Science (NAS) guidelines for maximum residues of toxicants in fish were equaled or exceeded 14 times while Food and Drug Administration (FDA) levels for toxic substances in fish for human consumption were exceeded only once. Per the NAS guidelines, mercury, toxaphene and total DDT concentrations approached or exceeded allowable levels at 5, 5, and 3 sites, respectively, while FDA limits for mercury were approached or exceeded at 2 sites. Copper concentrations were very high at 2 locales. Twenty-two synthetic organic compounds were detected at the parts per trillion level. Recommendations for future action include: analyzing individual organisms as well as different species in known problem areas; sampling identified problem areas less often so that efforts could center on other water quality problem areas; seeking the active participation of the Regional Boards and other agencies; developing a strong data base from which toxicant levels can be classified and later evaluated relative to their severity; continue developing sample consistency relative to species collection; studying toxicant concentrations in fish of different size, weight, age and species; and possibly using plant materials as water quality indicator organisms for selected toxicants. (Atkins-Omniplan)
W83-02719

AQUATIC HABITAT PROGRAM PLAN FOR ASSESSING THE EFFECTS OF POLLUTANTS IN THE SAN FRANCISCO BAY-DELTA ESTUARY,

California State Water Resources Control Board, Sacramento.

For primary bibliographic entry see Field 5C.
W83-02721

ASSESSMENT OF SURFACE WATER QUALITY AT SLECTED NORTHWESTERN WISCONSIN SITES BY COMBINED BIOLOGICAL AND CHEMICAL TECHNIQUES,
Wisconsin Univ.-Superior. Center for Lake Superior Environmental Studies.
T. P. Markee, D. A. Bahnick, D. J. Call, and L. T. Brooke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191890, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Publication No WIS WRC 83-04, Univ. of Wisconsin, Madison, 1982. 20 p, 6 Tab, 12 Ref. OWRT A-086-WIS(1), 14-34-0001-0153.

Descriptors: *Chemical analysis, Surface water, *Water quality, Algae, *Bioassay, Metals, Nutrients, Sampling, *Seasonal variation, *Wisconsin, *Algal assay, Water analysis, *Pollutant identification, Algal growth, Organic toxins, Phosphorus, Nitrogen, Inland lakes, Amnicon Lake.

Algal assays were utilized in this project for several types of studies: (1) determination of the water quality of several waterbodies in northern Wisconsin, (2) an attempt to develop an assay to indicate the presence or organic toxins, (3) seasonal variation in the ability of an inland lake to support algal growth, and (4) the comparison of a 48 hr bioassay technique with the standard 14 day test. The results of the water quality studies indicated that phosphorus was the limiting nutrient in waters from the three sample sites, and that nitrogen became limiting when phosphorus was added. Addition of the metal complexing agent--EDTA--caused changes in biomass production in two of the three sites. The attempt at developing a test for organic toxins was not successful because the extraction procedure seemed to remove nutrients or micronutrients resulting in decreased algal growth. Seasonal analysis of test samples resulted in only minor fluctuations in production from one month to another. The limited results of the 48 hr fluorescence test indicated comparable findings with that of the 14 day test.
W83-02736

ESTIMATION OF THE SEWAGE LOADING OF THE MEDITERRANEAN AT THE BEACHES OF VALENCIA, SPAIN (ESTIMACION DE LA CARGA CONTAMINANTE VERTIDA AL MAR MEDITERRANEO EN EL LITORAL PROXIMO A LA CIUDAD DE VALENCIA (ESPANA)),
Sociedad d'Aguas Potables Mejoras de Valencia (Spain).
For primary bibliographic entry see Field 5B.
W83-02796

5B. Sources Of Pollution

ACCLIMATION TO AND BIODEGRADATION OF NITRILOTRIACETATE (NTA) AT TRACE CONCENTRATIONS IN NATURAL WATERS,
Procter and Gamble Co., Cincinnati, OH. Ivorydale Technical Center.
R. J. Larson, and D. H. Davidson.
Water Research, Vol 16, No 12, p 1597-1604, December, 1982. 4 Fig, 4 Tab, 42 Ref.

Descriptors: *Nitrilotriacetic acid. *Degradation, *Detergents, Fate of pollutants, Acclimatization, *Biodegradation, *Microbial degradation, Kinetics.

Microbial acclimation to and degradation of nitrilotriacetic acid (NTA) was studied at concentrations up to 1000 micrograms per liter in river waters with varying histories of NTA exposure via detergents. In rivers previously unexposed to NTA, acclimation and degradation occurred at the lowest initial concentration, 1 microgram per liter. Degradation after acclimation followed apparent first-order kinetics. Half lives for NTA removal in the unexposed waters were 7 hours (at 50 micrograms per liter NTA) to 138 hours (5 micrograms per liter). No acclimation was observed before degradation in water samples previously exposed to NTA. In these waters first order rate constants varied only slightly over a 1000-fold initial concentration of 1-1000 micrograms per liter; half lives were 7-17 hours. The NTA levels found in the environment do not represent threshold concentrations for microbial action but rather steady state levels. (Cassar-FRC)
W83-02461

BEHAVIOR OF URANIUM IN TWO ESTUARIES OF THE SOUTHEASTERN UNITED STATES,
Tokyo Univ. of Fisheries (Japan).
For primary bibliographic entry see Field 2L.
W83-02465

SEASONAL VARIABILITY OF BIOLOGICAL ARSENIC METHYLATION IN THE ESTUARY OF THE RIVER BEAULIEU,
Southampton Univ. (England). Dept. of Chemistry.
A. G. Howard, M. H. Arbab-Zavar, and S. Apte.
Marine Chemistry, Vol 11, No 5, p 493-498, 1982. 2 Fig, 2 Tab, 12 Ref.

Descriptors: *Seasonal variation, *Arsenic, *Methylation, Methyl arsenic, Rivers, Estuaries, Fate of pollutants, *Beaulieu River, Test River, Itchen River, *United Kingdom, Phytoplankton, Algae, Marine algae, Water temperature, *Path of pollutants.

Soluble arsenic species in surface water of the Rivers Beaulieu, Test, and Itchen near the Isle of Wight, England, showed strong seasonal variation. Inorganic arsenic (5+) concentrations ranged from 0.13 to 1.02 micrograms per liter throughout the year. Inorganic As(3+) and mono- and dimethylated As were absent during the winter months. The temperature range 9-12C was a transition region in which very small amounts of methylated As were formed. Above that range methylated As was detected in 80-100% of samples in concentrations of 0.06-0.38 micrograms per liter (monomethyl) and 0.16-0.42 micrograms per liter (dimethyl). Inorganic arsenic was detected in water of 3-6C and 12-18C but not at intermediate or higher temperatures. It was not possible to determine the specific organisms which participate in As methylation. Arsenite levels were higher in near bottom samples than in corresponding surface water samples, but no similar trend was seen in methylated As levels. This may reflect salinity stratification and remobilization of As from bottom sediments. (Cassar-FRC)
W83-02471

TRANSPORT OF ION-EXCHANGING SOLUTES DURING GROUNDWATER RECHARGE,
Stanford Univ., CA. Dept. of Civil Engineering.
A. J. Valocchi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190439, Price codes: A12 in paper copy, A01 in microfiche. Ph.D. Thesis, December 1980. 247 p, 89 Fig, 8 Tab, 94 Ref, 2 Append. OWRT C-80264-R(No 8824)(2), 14-34-0001-8824.

Descriptors: *Groundwater recharge, Model studies, *Ion exchange, Data collections, *Porous media, Water quality, *Solute transport, *Dispersion, *Chromatography, Soil columns, Path of pollutants, *Finite element analysis.

A mathematical model of the transport of ion-exchanging species governed by local chemical equilibrium was developed, based upon steady flow in a two-dimensional areal, confined, leaky aquifer system. The model equations were solved by use of the Galerkin-Finite Element Method. To study the effect of chemical parameter variations upon transport model behavior, a detailed chromatographic analysis of ion exchange in a non-dimensional soil column was also performed for both homovalent and heterovalent exchange in binary and ternary systems. The chromatigraphic analysis was extended to the case of ideal radial flow from a single injection well and was also used to investigate the effects of solution phase activity corrections and equilibrium model formulation upon the behavior of the transport model. The transport model was applied to a local field project involving direct injection of advanced-treated municipal effluents. Hydrogeologic parameters were determined by inspection of well logs and core samples. Tracer breakthrough data were used to determine an approximate velocity field and dispersivity values. Chemical parameters were measured using standard batch laboratory experiments on aquifer core material. The simulation model was then run to predict the breakthrough of sodium, potassium, magnesium, and calcium at various observation wells. The predicted results agreed very closely with the field data, showing that laboratory-determined chemical parameter values can be successfully used in field scale transport simulations, if the hydrogeologic and hydrodynamic parameters are selected to simulate reliably the movement of a conservative tracer.
W83-02478

THE MICROBIAL DYNAMICS OF AN EPILITHIC ALGAL-BACTERIAL MAT COMMUNITY IN AN OLIGOTROPHIC, HIGH ALPINE STREAM,
Montana State Univ., Bozeman. Dept. of Microbiology.
G. A. McFeters, and T. K. Haack.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186148, Price codes: A03 in paper copy, A01 in microfiche. Montana Water Resources Research Report No 122, Bozeman, April 1982. 31 p, 6 Fig, 2 Tab, 27 Ref. OWRT A-131-MONT(1), 14-34-0001-1128.

Descriptors: *Microbiological studies, *Algal growth, *Heterotrophic bacteria, *Phototropism, Metabolites, *Montana, Algalmats, Sessile bacteria, Mountain streams.

Previous studies of an epilithic algal-bacterial community in a pristine mountain stream suggested that heterotrophic bacteria were responding to the metabolic activities of the phototrophic population. Subsequent studies were performed to follow the flow of labeled carbon, from its initial inorganic form, through the trophic levels of the mat community. A majority of primary production metabolites were excreted by the algal population during active growth; this shifted to an incorporation into cellular material as phototrophic activity declined. Results suggest that there was a direct flux of soluble algal products to the bacterial population, with little heterotrophic utilization of dissolved organics from the overlying stream water. Both phototrophic productivity and bacterial utilization of algal products peaked at approximately the same time of year. Activity of the diatom-dominated algal population declined as silica concentrations in the stream water dropped, leading to a situation in which the sessile bacteria were substrate limited. These events resulted in an almost complete disappearance of the community of the community in early September.
W83-02490

PARAMETERS OF DETERIORATING MICROBIOLOGICAL QUALITY OF SELECTED SURFACE WATERS IN RESIDENTIAL MISSOULA, MONTANA,
Montana Univ., Missoula. Dept. of Microbiology.
J. J. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186452, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Center Report No 121, Montana State Univ., Bozeman, October 1981. 59 p, 6 Fig, 5 Tab, 69 Ref. OWRT A-123-MONT(1), 14-34-0001-0128.

Descriptors: Water quality, *Water pollution sources, *Enteric bacteria, *Pathogenic bacteria, Salmonella, Shigella, Irrigation canals, Public health, Membrane filter techniques, Giardia, Candida, Leptospira, *Montana, Missoula.

Recreational and irrigation waters become fecally contaminated as they flow through urban and sub-

urban Missoula. In warm weather, when the microbiological burden is generally greatest, children play in the contaminated waters risking ingestion of infectious microorganisms. This investigation was undertaken to determine the potential health hazard of the contaminated streams and ditches in residential areas by determining the extent of identifying the sources of and demonstrating the presence or absence of infectious fecal contamination in those waters. Qualitative and quantitative procedures for detection and enumeration of waterborne Shigella, Salmonella, Giardia, Candida, and Leptospira species were examined and evaluated. A new procedure for detecting, differentiating and enumerating Candida Albicans in water was developed using immunofluorescence techniques. Routine membrane filtration was done on data from sixteen stations and fecal bacterial indicator densities were determined. Optional procedures developed during the early investigations were applied to demonstrate and enumerate specified pathogens. At no time was it possible to detect Salmonella, Shigella or Giardia spp. in the collections; leptospires and Candida spp. were frequently detected from mid-July until September. Only the Candida species included known pathogens.
W83-02492

THE INFLUENCE OF KOKANEE SALMON AND MAN ON THE WATER QUALITY OF LOWER MCDONALD CREEK, GLACIER NATIONAL PARK, MONTANA,
Montana Univ., Missoula. School of Forestry.
For primary bibliographic entry see Field 5C.
W83-02494

PCBS IN LAKE GENEVA (LAKE LEMAN) FISH,
Ecole Nationale Veterinaire de Lyon (France). Lab. de Toxicologie.
For primary bibliographic entry see Field 5C.
W83-02513

THE OCCURRENCE OF PCH3-CONTAINING COMPOUNDS IN SURFACE WATERS,
Prins Maurits Lab. TNO, Rijswijk (Netherlands). Inst. voor Chemische en Technologische Research.
For primary bibliographic entry see Field 5A.
W83-02518

THE EPA-TEST – A METHOD FOR THE DETERMINATION OF PHOTOCHEMICAL DEGRADATION OF ORGANIC COMPOUNDS IN AQUATIC SYSTEMS (DER EPA-TEST--EINE METHODE ZUR BESTIMMUNG DES PHOTOCHEMISCHEN ABBAUS VON ORGANISCHEN VERBINDUNGEN IN AQUATISCHEN SYTEMEN),
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Freising-Weihenstephan (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W83-02519

EFFECT OF SOIL AND CONIFEROUS TREES ON SOME CHEMICAL CHARACTERISTICS OF THE WATER OF RESERVOIR LG2 (INFLUENCE DES SOLS ET ARBRES NOYES SUR QUELQUES CARACTERISTIQUES CHIMIQUES DE L'EAU DU RESERVOIR LG2),
Laval Univ., Quebec.
J. B. Serodes.
Canadian Water Resources Journal, Vol 7, No 1, p 355-374, 1982. 4 Fig, 4 Tab, 13 Ref. English summary.

Descriptors: *Soil types, *Reservoirs, *Flooding, Water quality, Vegetation, Peat bogs, Oxygen consumption, Anaerobic conditions, Aerobic conditions, Potassium, Calcium, Tannins, Color, Conductivity, *Quebec, La Grande 2 reservoir, Fate of pollutants.

In order to evaluate the modifications of some chemical properties of the water of La Grande 2 reservoir after flooding, experiments were performed on spruce and pine undergrowth soil, on peat bog and on spruce and pine trees. The influence of continuously aerated water was first tested. Then, after oxygen consumption, the same sample was used to evaluate the changes occurring under anoxic conditions. The findings indicate that at the beginning of flooding in oxygen saturated water or at the beginning of anaerobic conditions, a rapid increase in conductivity, color, tannins, potassium and calcium occurs. These variations diminish rapidly after a few days. Generally, the release of biogenic substances is higher during continuous aeration than in anaerobic conditions. The contribution of trees to these changes is much more important than that of their respective undergrowth soils. (Baker-FRC)
W83-02520

SLUDGE DISPOSAL IN SOUTHERN CALIFORNIA BASINS,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
For primary bibliographic entry see Field 5E.
W83-02527

PERSISTENT ORGANIC CHEMICALS IN SEWAGE EFFLUENTS. 2. QUANTITATIVE DETERMINATIONS OF NONYLPHENOLS AND NONYLPHENOL ETHOXYLATES BY GLASS CAPILLARY GAS CHROMATOGRAPHY,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 5A.
W83-02529

ENTRAPMENT OF ZINC AND OTHER TRACE ELEMENTS IN A RAPIDLY FLUSHED INDUSTRIALIZED HARBOR,
Maryland Univ., College Park. Dept. of Chemistry.
S. A. Sinex, and G. R. Helz.
Environmental Science and Technology, Vol 16, No 11, p 820-825, November, 1982. 5 Fig, 3 Tab, 21 Ref.

Descriptors: *Zinc, *Industrial wastes, *Harbors, *Fate of pollutants, *Trace metals, Metals, Baltimore Harbor, Sediments, Estuaries, Chesapeake Bay, Silt, Dredging, Cobalt, Chromium, Vanadium, Patapsco River, *Maryland.

Analysis of sediment cores from 13 sites in Baltimore Harbor showed that Al-containing fine-grained argillaceous sediments, accumulated in the upper reaches of the Harbor, effectively trapped trace metals such as Zn. This region is rapidly flushed (10% renewal each day) because of an unusual three-layer circulation system: inflow of low salinity surface water and high salinity bottom water and outflow of intermediate salinity water between the two layers. Sediments have also been disturbed for decades by shipping activities and dredging. As a result, sediment cores have erratic vertical profiles, with highly contaminated sediments sometimes underlying less contaminated material. Harbor sediments contain high levels of metals compared with Chesapeake Bay sediments. Al content increases from 6% at the mouth to 8% at the upper reaches. Silicon levels decrease toward the harbor, while Fe concentrations are fairly constant. Patterns of metals enrichment in sediments are somewhat erratic. However, V shows no enrichment, except in near shore samples; Cr shows increasing enrichment (2-7 fold) from mouth toward the upper reaches; Co shows decreasing enrichment (3-1 fold) from mouth toward upper reaches; and Zn is enriched throughout the harbor (3-7 fold). Estimates of total contaminated sediments in the subestuary were 91-140 million cu m or 34-99 times ten to the 12th power g; total Zn, 28-82 billion g; anthropogenic Zn, 21-62 billion g. Estimating the anthropogenic Zn discharged up to 1980 using population growth and other data gave a value of 42 billion g Zn. (Cassar-FRC)
W83-02545

UPTAKE, DEPURATION AND BIOTRANSFORMATION OF ANTHRACENE BY THE SCUD PONTOPOREIA HOYI,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
P. F. Landrum.
Chemosphere, Vol 11, No 10, p 1049-1057, 1982. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Organic compounds, *Biotransformation, *Bioaccumulation, Food chains, Water pollution effects, Pontoporeia hoyi, Uptake, *Anthracene, Industrial wastes, Benthic environment, Great Lakes, Lakes, Temperature effects, Fate of pollutants, *Lake Michigan, *Scud.

Uptake, depuration and biotransformation rates of 14C-anthracene were determined for Pontoporeia hoyi, the dominant benthic invertebrate for the Great Lakes at 4, 7, 10 and 15 degrees C. The uptake rate constants for anthracene increased from 136 per hr to 215 per hr over the temperature range studied and were seasonally dependent. The depuration rate constant at the apparent optimum temperature of 7 degrees C was 0.015/hr for anthracene. The biotransformation ability of P. hoyi is low, and degradation of anthracene was undetectable even after exposures of 48 hr. The bioconcentration factor can be predicted from the uptake and depuration kinetics to be about 16,800 at 4 degrees C. These experiments imply that P. hoyi may be very important in the food chain biomagnification of some toxic organics. (Baker-FRC)
W83-02549

MERCURY CONCENTRATION IN LIVER AND MUSCLE OF COD (GADUS MORHUA) AS AN EVIDENCE OF MIGRATION BETWEEN WATERS WITH DIFFERENT LEVELS OF MERCURY,
Havforskingsinstutt, Bergen (Norway).
K. Julshamn, O. Ringdal, and O. R. Braekkan.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 5, p 544-549, November, 1982. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Fate of pollutants, *Fish, *Mercury, *Tissue analysis, *Accumulation, *Bioindicators, *Fjords, Cod, Bioaccumulation, Indicators, Contamination, Livers, Muscle, *Norway.

Cod (Gadus morhua) caught in Masfjord north of Bergen in May 1980 were studied for inorganic mercury and methylmercury uptake and depuration in laboratory feeding experiments. Cod caught in 1978 and 1979 in the Frierfjord at the south coast of Norway were analyzed for levels of mercury in liver and dorsal muscle by a cold vapor technique. Results showed that mercury was accumulated most rapidly in the livers of fish fed inorganic mercury during the first 8 days. For 2 weeks into the depuration period mercury continued to accumulate in the liver, but it declined steadily in both liver and muscle during the final 2 weeks. Fish fed methyl mercury showed a much higher uptake, but a different distribution pattern between the two organs. Levels in the liver leveled off after 8 days, while dorsal muscle continued to accumulate mercury for the whole 32-day feeding period. In the depletion period, the liver showed a decrease which mas most pronounced during the first week and continued until the last week of the experiment. These findings suggest that an internal redistribution of methyl-mercury takes place and that muscle tissue has a higher storage capacity than liver. These data also indicate that a muscle-liver ratio for mercury above 1 should show equilibrium with the environment. A plot of the muscle-liver ratios for cod caught in the Frierfjod area showed that less than half of the samples had a ratio exceeding 1, suggesting that cod from this environment may migrate between waters with different degrees of mercury contamination. Therefore, cod would not be a good indicator organism for mercury pollution in this area, nor could suitable relationships be drawn beteen fish age and levels of mercury accumulation in tissues. (Geiger-FRC)
W83-02553

RESTORATION OF THE CENTRAL LAKES: BALDEGGERSEE, HALLWILERSEE, AND SEMPACHERSEE. GENERAL OVERVIEW

(DIE SANIERUNG DERMITTELLANDSEEN: BALDEGGERSEE, HALLWILERSEE UND SEMPACHERSEE. ALLGEMEINER UBERBLICK),
Luzern Kantolales Amt fuer Gewasserschultz (Switzerland).
For primary bibliographic entry see Field 5G.
W83-02558

TRANSPORT AND FATE OF HEAVY METALS IN ONONDAGA LAKE, NEW YORK,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
T. C. Young, J. V. DePinto, and E. S. Seger.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 5, p 554-561, November, 1982. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Nickel, *Chromium, *Zinc, *Lakes, *Fate of pollutants, Mathematical models, *Heavy metals, Lake sediments, Sedimentation, Model studies, Simulation analysis, Mathematical studies, Epilimnion, Hypolimnion, *New York, Onondaga Lake, *Path of pollutants.

A simple, nonsteady state, deterministic model for prediction of the behavior of zinc (Zn), nickel (Ni) and chromium (Cr) in Onondaga Lake, New York was developed in three stages. In the first stage, important physical transport charateristics of the lake were described mathematically to include morphometric properties, point and non-point inputs, advective and dispersive fluxes, and outputs. Second, the transport model was calibrated for the period of study by a time-dependent mass balance on chloride ion. The calibrated tranport model then formed the basis for prediction of in-lake concentrations of the heavy metals. The calibrated model revealed that flow at the lake outlets may be unidirectional in either direction, or may be bidirectional. During bidirectional flow, water leaves Onondaga Lake from the hypolimnion of the north basin while water from the Seneca River enters the north basin epilimnion. The Nine Mile Creek tributary enters the hypolimnion of the north basin while about 10% of the flow from this creek reaches the outlet in the north basin without mixing. Horizontally, the lake is well-mixed, and the effect of thermocline migration on vertical dispersion was not important to in-lake transport. The model was recalibrated by adjusting for sedimentation coefficients and used to predict Zn, Ni and Cr loading in the lake. Comparisons with measured concentrations showed that the model accurately predicted the magnitude of heavy metal concentrations and general trend toward increasing or decreasing concentrations during the simulation period. Model estimates showed that 38% of the external Zn load and 36% of each of the Ni and Cr loads were lost to the sediments during the four month study period. (Geiger-FRC)
W83-02562

MUTAGENICITY OF SRC-II COAL LIQUEFACTION WASTEWATER TREATMENT RESIDUES,
Pittsburgh Univ., PA. Graduate School of Public Health.
For primary bibliographic entry see Field 5D.
W83-02564

INITIAL SEDIMENTATION OF WASTE PARTICULATES DISCHARGED FROM OCEAN OUTFALLS,
R. C. Y. Koh.
Environmental Science and Technology, Vol 16, No 11, p 757-763, November, 1982. 10 Fig, 8 Ref.

Descriptors: *Sludge disposal, *Ocean dumping, *Sedimentation, Ocean bottom, Outfalls, Particulate matter, Organic matter, Santa Monica Basin, San Pedro Basin, *California, Settling velocity, Model studies, Fate of pollutants.

A model was developed to evaluate the physical pattern formed by discharge of sewage sludge particles into deep ocean basins from a 400 m deep outfall in the Santa Monica-San Pedro Basin off the California coast. Three types of information were needed: fall velocities of particles, ocean currents and density stratification at the site, and flow rate and other characteristics of the discharges. The fall velocities and currents were unavailable. Therefore, orders of magnitude for these data were used in the model. Model results showed that fall velocity is very variable and is influenced significantly by flocculation. Upon discharge the sludge would rise about 50 m above the bottom and then migrate toward the bottom by falling and downward diffusion. Only a few percent of the particles would settle within a kilometer of the outfall. About half of the sludge would be distributed over 100 sq km in an elongated, oblong-shaped region. This is caused by ocean currents which are stronger in the direction of the bottom contour axes. (Cassar-FRC)
W83-02565

EVALUATION OF ORGANOCHLORINE CONTENTS IN THE SAINT LAWRENCE RIVER, ESTUARY AND GULF, CANADA (EVALUATION DES TENEURS EN COMPOSES ORGANOCHLORES DANS LE FLEUVE, L'ESTUAIRE ET LE GOLFE SAINT-LAURENT, CANADA),
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
D. Couillard.
Environmental Pollution, Series B, Vol 3, No 4, p 239-270, 1982. 3 Fig, 12 Tab, 46 Ref.

Descriptors: *Reviews, *Water pollution, *Chemical analysis, Water analysis, Rivers, Lakes, Gulfs, *St. Lawrence River, Great Lakes Basin, *Canada, United States, River sediments, Sedimentation, *Organochlorines, Pesticides, Industrial wastes, Agricultural wastes, Fate of pollutants, Pollutant identification.

This literature review is based on reports and studies of concentrations of organochlorine compounds in the St. Lawrence River, Estuary and Gulf. The St. Lawrence River drains the Great Lakes Basin of Canada and the United States, which contains waters contaminated by organochlorine pesticides and polychlorobiphenyls (PCBs). The region of Montreal, as well as Lake Saint-Louis and Lake Saint-Francois, is the most contaminated area studied thus far. The sediments of Lake Saint-Louis generally contain 150 micrograms PCB/kg, while the river sediments south of Montreal island contain 75-140 micrograms/kg. In addition to these highly contaminated areas with respect to PCBs, the entire river between Cornwall and Ile d'Orleans is contaminated by organochlorine compounds. Both PCB and organochlorine concentrations in sediments and fish were highest in Lake Sain-Francois and decline downstream. The estuary and gulf areas are less contaminated than is the river, with 20-50 micrograms of PCB/kilogram of sediment being found at Ile D'Orleans and very low concentrations of PCBs and organochlorine compounds in fish flesh. Concentration gradients of PCB and organochlorine compounds in the estuary and gulf areas were not able to be defined. Concentrations were uniform and much lower than those measured in the river. (Baker-FRC)
W83-02578

TRACE ELEMENTS IN TISSUES OF COMMERCIAL FISH FROM LAKE LADOGA,
Ministerstvo Zdravookhraneniya URSR, Kiev. Inst. Biologicheskoi Fiziki.
P. I. Drovot.
Hydrobiological Journal, Vol 17, No 6, p 59-62, 1981. 2 Tab, 8 Ref.

Descriptors: *Fate of pollutants, *Fish, *Lakes, Water pollution effects, Iron, Manganese, *Trace elements, Metals, Cobalt, Copper, Lead, Zinc, Strontium, Nickel, Vanadium, Titanium, Zirconium, Lanthanum, *USSR, Lake Ladoga.

The results of a determination of 13 chemical elements in the tissues of eight species of edible fish from Lake Ladoga, caught in the summer of 1976 are presented. The highest concentrations of trace elements were found in the muscle and bony tissue of the roach, whitefish and ripus and the lowest concentrations in these tissues of the pike-perch and smelt. Lake Ladoga and its tributaries are inhabited by 58 varieties of fish. The variability in the concentrations of trace elements in the tissues of the different species of fish investigated depended on the habitat, physiological characteristics and mode of feeding. The content of trace elements in the tissues and organs of the fish increased in the following order: muscles, internal organs, skin, gills, skeleton and scales. Iron, manganese, zinc and strontium dominate among the elements studied. (Baker-FRC)
W83-02598

90SR AND 137CS IN BOTTOM SEDIMENTS OF A FRESHWATER LAKE,
Akademiya Nauk SSSR, Sverdlovsk. Inst. of Plant and Animal Ecology.
M. Ya. Chebotina, and V. F. Bochenin.
Hydrobiological Journal, Vol 17, No 6, p 77-80, 1981. 1 Tab, 14 Ref.

Descriptors: *Bottom sediments, *Lakes, *Trace elements, *Strontium, *Cesium, Natural waters, Sand, Peat, Lime, Sapropel, Sedimentation, Lake sediments, Fate of pollutants, Radionuclides.

Accumulation of Sr-90 and Cs-137 by four types of bottom sediments of a freshwater lake (sandy, peaty, lime and sapropel) was studied under natural conditions. It was noted that Sr-90 content in the sediments varied from 30 to 2300 pCi/kg (on a dry weight basis), and accumulation coefficients from 75 to 600. Sr-90 was absorbed mostly by peaty bottom sediment, and to the least extent by the sandy one. Cs-137 content in the bottom sediment was within the limits of 1700 to 3000 pCi/kg, and accumulation coefficients were 2000 to 4200. The highest degree of Cs-137 accumulation was registered for sapropel, which was due to its smaller particle size. (Baker-FRC)
W83-02599

LONG-TERM FATE OF ORGANOCHLORINE XENOBIOTICS IN AQUATIC ECOSYSTEMS. DISTRIBUTION, RESIDUAL BEHAVIOR, AND METABOLISM OF HEXACHLOROBENZENE, PENTACHLORONITROBENZENE, AND 4-CHLOROANILINE IN SMALL EXPERIMENTAL PONDS,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Okologische Chemie.
W. Schauerte, J. P. Lay, W. Klein, and F. Korte.
Ecotoxicology and Environmental Safety, Vol 6, No 6, p 560-569, 1982. 5 Fig, 5 Tab, 9 Ref.

Descriptors: *Chlorinated compounds, *Pesticide residues, *Aquatic life, Ponds, Organic compounds, Fate of pollutants, Hexachlorobenzene, Pentachloronitrobenzene, *Chloroaniline, Aromatic compounds, Sediments, Adsorption, Degradation, Aquatic plants, Fish, Invertebrates.

The fate of pesticides in pond water, sediments, and aquatic life was followed for up to 166 weeks after application over a 4-6 week period. Initial concentrations of hexachlorobenzene (HCB), pentachloronitrobenzene (PCNB), and 4-chloroaniline (CA) were 50 micrograms per liter. In the water phase half lives of HCB and PCNB after the last application were 1.3 and 1.8 days, respectively. CA was more persistent, with a first phase half life of 3 days and a second phase half life of 11 days. Rates of disappearances were partially correlated with physicochemical properties such as volatility and vapor pressure. Concentrations of all compounds were high in the biota in the first year but declined rapidly and remained very low thereafter. Sediment concentrations reached a peak early in the first year; those of HCB and PCNB declined sharply and remained low and those of CA declined gradually. After 3 years, residues of 0.1 mg per kg pesticide were detected in some fauna (backswimmers and libellula larvae) and in the 0-20 cm sediment layer. Three years after application the sediments still contained 7% of applied HCB and 6% of applied PCNB. No residues were found in the second crop of aquatic vegetation. No HCB conversion products were found. PCNB was quantitatively converted to pentachloroaniline and pentachlorothioanisole by 30 weeks after application. A brown film of CA degradation products was

seen on the surface of the water after 1 day. (Cassar-FRC)
W83-02608

DISTRIBUTION OF ACTINOMYCETES IN NATURAL WATERS (A SURVEY),
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
N. A. Gavrishova.
Hydrobiological Journal, Vol 17, No 6, p 24-31, 1981. 70 Ref.

Descriptors: Natural water, *Actinomycetes, *Bacteria, Water quality, Bottom sediments, Sediments, Water pollution sources, Reviews, Seasonal variations, Temperature effects, Algal growth, Algae, *Literature reviews.

A review of the literature is presented on distribution of actinomycetes in soils, bottom sediments, different water bodies and water courses. The effect of actinomycetes as antagonists and producers of biologically active metabolites on water quality is affected by seasonal dynamics, qualitative composition and physiological activity. The data indicate that the number of actinomycetes in bottom sediments is quite comparable to that in the soil, but that in water the numbers of these bacteria are tens of thousands of times smaller than in bottom sediments. Nevertheless, actinomycetes can develop in water, participating in the conversion of many substances within such waters. The relatively high rate of occurrence of actinomycetes in the water of estuarine regions of rivers, in inlets and shallows, as well as their response to man-made pollutants suggest that actinomycetes can act as indicators of such pollutants in water. Actinomycetes also serve as indicators in the trophic cycle and are involved in the conversion of various substances, promoting contamination and self-purification of waters. Questions of ecology of aquatic actinomycetes, the definition of their abundance, qualitative composition, role in the nutrition of aquatic animals, and their physiological and biochemical activity are areas indicated for further study. (Baker-FRC)
W83-02624

INVESTIGATIONS ON SEASONAL VARIATIONS OF SAPROBITY IN FLOWING WATER (UNTERSUCHUNGEN UBER JAHRESZEITLICHE VERANDERUNGEN DER SAPROBITAT IN EINEM FLIESSGEWASSER),
Wasserwirtschaftsdirektion Saale-Werra, Erfurt (German D.R.).
H. Ziemann, and W. Tumpling.
Acta Hydrochimica et Hydrobiologica, Vol 9, No 2, p 131-146, 1981. 3 Tab, 9 Fig, 17 Ref. (No English Summary).

Descriptors: *Saprophytic bacteria, *Seasonal variation, Running waters, *Water temperature, *Pollution load, Water pollution, Water quality, *German Democratic Republic, Rivers, Unstrut river, Organic loading, Chemical oxygen demand, Heterotrophic bacteria, Light intensity, Oxygen balance.

Saprobity (Pantle and Buck's saprobe index) and other water-quality factors (COD, oxygen, ammonium ions, temperature) were determined in the upper and middle reaches of the Unstrut river (German Democratic Republic) to investigate seasonal variation. Three sections of the river were distinguished: lightly polluted upper reaches, heavily polluted sections of the upper reaches, and moderately to heavily polluted (in fall, constantly heavily polluted) middle reaches. The middle reaches in spring and summer were autotrophic, and in fall and winter were heterotrophic, with a change in saprobity of one or two quality categories; this was effected by the heavy pollution in fall. Saprobity was correlated with COD-Mn ($r = -0.84$ at temperatures > 5 C, $+0.79 < 5$ C), oxygen saturation index ($r = -0.69$ both $>$ and $<$ 5 C), ammonium ions, and temperature itself except in the lightly polluted section ($r = -0.88$ and -0.81 for the heavily and periodically polluted sections, respectively; -0.21 for the lightly polluted section). In the upper reaches, organic pollution and oxygen concentration were most influential, while in the middle reaches, temperature and organic pollution were most important. The increase in saprobity noted in winter in heavily polluted running waters is not a natural phenomenon but is usually the consequence of the level of organic pollution in fall; after a critical threshold of pollution, autotrophic organisms cannot compete with heterotrophs, even after the pollution load is reduced. Only organic pollution was a determining factor for the stability of this ecosystem, while temperature and light served only to maintain stability after its level was established. (Gish-FRC).
W83-02640

DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBONS IN THE NEW YORK BRIGHT AREA,
National Marine Fisheries Service, Gloucester, MA. Gloucester Lab.
A. W. Humason, and D. F. Gadbois.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 6, p 645-650, 1982. 2 Fig, 3 Tab, 6 Ref.

Descriptors: *Fate of pollutants, *Hydrocarbons, *Aromatic compounds, *Bights studies, *Marine animals, Water pollution sources, Oragnic wastes, Carcinogens, Fish, Mollusks, Crustaceans, *New York Bight, *Polynuclear aromatic hydrocarbons, New York.

Levels of 10 selected polynuclear aromatic hydrocarbons (PAH) were monitored in samples of winter flounder, window pane, red hake, rock crab, lobster, and sea scallops collected from the New York Bight and Long Island Sound regions. The specimens were frozen until analysis by high performance liquid chromatography. Results showed that of ten PAH compounds studied, the largest PAH concentrations found were for phenanthrene in the 50-200 parts per billion range (ppb). Concentrations for the other PAH compounds ranged from 0 to 50 ppb in most samples. Naphthalene, acenaphthalene, acenaphthene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene were detected the least frequently in the specimens studied. Low yields for benzo(a)pyrene were attributed to the rapid photodecompostion of this compound. Since sample size was so small and these data were iniended to serve only as a baseline study, no geographic significance has been placed on these results. Followup studies will be needed to follow the extent of PAH pollution in the New York Bight area. (Geiger-FRC)
W83-02642

FATE OF ACETONE IN WATER,
Geological Survey, NSTL Station, MS.
R. E. Rathbun, D. W. Stephens, D. J. Shultz, and D. Y. Tai.
Chemosphere, Vol 11, No 11, p 1097-1114, 1982. 1 Fig, 4 Tab, 44 Ref.

Descriptors: *Acetone, *Volatility, *Degradation, Solvents, Organic compounds, *Fate of pollutants, Bacteria, *Biodegration, *Adsorption, Sediments, Streams, Rivers, Algae, Molds, *Photodegradation.

Volatilization and bacterial degradation were the dominant processes determining the fate of acetone in streams, according to results of laboratory studies, which also included the processes of adsorption by sediments, algae, and molds, and photodecomposition. Acetone volatilization coefficients, much smaller than oxygen absorption coefficients, were relatively independent of mixing conditions except in the low mixing range. The volatilization coefficients ranged from 0.625 per day for very low mixing conditions to 2.31 per day for very high mixing conditions. Bacteria preconditioned with a small concentration of acetone had a lag time before beginning of degradation of 1-3 hours, compared with nontreated bacteria with a lag time of 5-19 hours. Degradation rate coefficients were 0.79-7.9 per day for bacteria with no pretreatment and 0.43-3.4 per day with acclimated bacteria. It is expected that degradation rate coefficients in natural streams would be smaller than these values. Addition of a dye, Rhodamine-WT, to a water-acetone solution showed no significant photodecomposition of the acetone by the dye or of the dye by the acetone. Acetone did not significantly adsorb on sediments, algae, and molds. Initial acetone concentrations (mg per liter) in the experiments were: volatilization, 130; sediment adsorption, 38-925; bacterial degradation, 16-158; and algae and mold adsorption, 1.6-400. (Cassar-FRC)
W83-02645

POLLUTION OF DRINKING WATER WITH NITRATE,
Bremer Umweltinstitut fuer die Analyse und Bewertung von Schadstoffen (Germany, F.R.).
B. Gabel, R. Kozicki, U. Lahl, A. Podbielski, and B. Stachel.
Chemosphere, Vol 11, No 11, p 1147-1154, 1982. 2 Fig, 2 Tab, 18 Ref.

Descriptors: *Nitrates, *Manure, *Drinking water, Water pollution sources, Agriculture, Fertilizers, *Federal Republic of Germany, *Nonpoint pollution sources, Path of pollutants, Fate of pollutants.

High nitrate levels in drinking water in West Germany and intensive use of animal manures on agricultural land were highly correlated. Maps depict the areas of heavily cultivated land high nitrate levels in drinking water supplies, some over 250 mg per liter. The higher nitrate levels are found around Hamburg, Hanover, south of Bremen, west of Essen and Cologne, around Frankfurt, north of Stuttgart, northeast of Munich, in the Moselle Valley, and in several other regions. Only a few small areas of highly intensive cultivation were found without high nitrate concentrations in drinking water. (Cassar-FRC)
W83-02646

SIMULATION OF DECOMPOSITION OF PLANT MATERIAL AND FLOODED SOILS IN THE RESERVOIRS OF THE JAMES BAY REGION (SIMULATION DE LA DECOMPOSITION DE LA MATIERE VEGETABLE ET DES SOLS INONDES DANS LES RESERVOIRS DE LA REGION DE LA BAIE DE JAMES),
Sherbrooke Univ. (Quebec). Faculte des Sciences Appliquees.
N. Therien, G. Spiller, and B. Coupal.
Canadian Water Resources Journal, Vol 7, No 1, p 375-396, 1982. 10 Fig, 21 Ref.

Descriptors: *Model studies, *Water quality, *Reservoirs, Floods, Soil types, Vegetation, Hydraulics, James Bay, Fluid mechanics, *Decomposition, Water pollution sources, Desaulniers reservoir, Computer models, *Canada.

The effects of flooding of vegetation and soils on the water quality of the Desaulniers reservoir were considered. The reservoir is a small experimental reservoir located near the LG-2 reservoir. A computer model of the decomposition of flooded vegetation and soils was constructed. Inputs to the model consist of daily water temperature values, hydraulic convective mass flows entering the volume under study, and the initial state of the reservoir at the time of flooding. The type of soil and the distribution of vegetation species with their respective organic content are also initial inputs to the model. The model has been verified using experimental results available from flooded vegetation decomposition and soil leaching experiments. The model was run for two years after flooding. Model predictions are compared with available data for the Desaulniers reservoir and the influence of the hydraulic regime on the results are discussed. Management techniques include cutting or burning the vegetation before flooding. (Baker-FRC)
W83-02669

THE POPULATIONS, CHARACTERIZATION AND ACTIVITY OF SUSPENDED BACTERIA IN THE WELSH RIVER DEE,
University Coll., Galway (Ireland). Dept. of Microbioloby.
D. Nuttall.
Journal of Applied Bacteriology, Vol 53, No 1, p 49-59, 1982. 5 Fig, 2 Tab, 42 Ref.

Descriptors: *Heterotrophic bacteria, *Water pollution sources, *Fate of pollutants, *Aerobic bacteria, Rivers, *Population dynamics, Pollutant identification, Bacteria, Pseudomonas, Alcaligenes, Flavobacterium, Seasonal variations, Escherichia coli, Dee River *Wales.

A 29-month study of the variations in total and aerobic heterotrophic bacterial populations from three sites on the River Dee and an evaluation of intensity differences and seasonal trends in potential heterotrophic activity were conducted from October 1975 to February 1978. Aerobic heterotrophic bacteria populations increased from an average basal level of about 12,000 colony-forming units (cfu)/milliliter at the river source to 200,000 cfu/milliliter in the lowland reaches. The total bacterial cell count: viable count ratio decreased from 70 in the upper reaches to 10 in the lower parts of the river. No seasonal variations were observed in bacterial numbers. Bacterial isolates from both upper and lower reaches were dominated by the Pseudomonas-Agrobacterium-Alcaligenes group and the Flavobacterium-Ctyophaga-Flexibacter group. Results suggest that the latter group may belong to the autochthonous population. Seasonal variation in heterotrophic potential for acetate uptake occurred over a 30-fold range in the lower reaches of the river. Peaks in activity in the lowland site occurred during the summer months, while fluctuations in heterotrophic potential for the upland site were not seasonal, but instead were associated with fecal pollution from sewage treatment facilities. (Geiger-FRC)
W83-02707

LONG-TERM TRENDS IN NITRATE CONCENTRATION IN IOWA WATER SUPPLIES,
Iowa Univ., Iowa City. State Hygienic Lab.
D. B. McDonald, and R. C. Splinter.
Journal of the American Water Works Association, Vol 74, No 8, p 8,437-440, August, 1982. 4 Fig, 3 Tab, 4 Ref.

Descriptors: *Nitrate, *Fertilizers, *Anhydrous ammonia, *Groundwater pollution, *Rivers, Water pollution, Water pollution sources, Agricultural runoff, Agricultural chemicals, Agricultural watersheds, Water quality, Shallow wells, Deep Wells, *Iowa.

Increases in nitrate concentrations in surface waters and shallow wells were found in long-term water quality studies in Iowa. High nitrate (more than 45 mg/liter) values were common during periods of relatively low river flow in the fall and winter. Nitrate infiltration of shallow aquifers was also evident from shallow well samples. The increased levels of nitrate were not unexpected because of the steady increase in the use of anhydrous ammonia in Iowa. Groundwater from deeper wells had much lower nitrate levels than groundwater from shallow wells. Nitrate contamination has not yet reached the deeper aquifiers. The future of nitrate contamination has not yet reached the deeper aquifers. The future of nitrate contamination in the area depends upon the use of fertilizer and other farming practices. (Small-FRC)
W83-02711

FATE OF NITROGEN IN SHALLOW STREAMS: FOCUS ON NITRIFICATION,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
J. J. Warwick, and A. J. McDonnell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191783, Price codes: A10 in paper copy, A01 in microfiche. Completion Report, Institute for Research on Land and Water Resources, The Pennsylvania State Univ., University Park, March 1983. 203 p, 35 Fig, 37 Tab, 138 Ref, 4 Append. OWRT B-123-PA(1), 14-34-0001-1260.

Descriptors: *Nitrogen, *Nitrification, *Denitrification, *Dissolved oxygen, *Mathematical models, Aquatic plants, Self-purification, Natural streams, *Pennsylvania, Marsh Creek, Pine Creek watershed.

A one-dimensional, pseudo unsteady-state water quality model was constructed to simultaneously solve nitrogen and dissolved oxygen mass balance equations developed for a stream environment. The nitrogen mass balance equations incorporate the following transformation pathways: ammonification, nitrification, bacterial and aquatic plant nitrogen assimilation, ammonia exsolution, and denitrification. The ammonification, nitrification, and denitrification reaction rates were treated optionally using either zero- or first-order kinetics. Submodels were developed to: (1) describe bacterial nitrogen uptake in terms of carbonaceous and nitrogenous biochemical oxygen demand removal rates, (2) estimate aquatic plant nitrogen assimilation from the variation in net primary productivity rates, and (3) calculate ammonia-N exsolution rates as a function of stream temperature and pH. The dissolved oxygen mass balance equation includes: atmospheric reaeration, carbonaceous deoxygenation, nitrogenous deoxygenation (nitrification), photosynthetic oxygen production, aquatic plant respiration, and benthal oxygen demands. Three separate water quality surveys were conducted to establish a data base for model calibration and verification. A shallow, headwater stream, exhibiting strong diel variations in pollutant loading and subsequent water quality response, was selected for investigation. The relative importance of all nitrogen transformation pathways was evaluated. The validity of utilizing observed variation in various nitrogen species concentration to estimate in-stream nitrification rates was investigated. The strong diel variation in calculated in-stream nitrification rates was related to observed variations in both stream temperature and pH.
W83-02723

CADMIUM FATE IN BACTERIAL MICROCOSMS,
Liege Univ. (Belgium). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W83-02764

HALTING CREEK POLLUTION,
Rogue Valley Council of Governments, Central Point, OR.
E. Dittmer.
Public Works, Vol 113, No 12, p 39-40, December, 1982.

Descriptors: *Animal wastes, *Coliforms, *Parks, Recreation, Water pollution sources, Streams, Urban areas, Water treatment, Chlorination, Raccoons, Bacteria, *Oregon, Bear Creeks.

Even after elimination of a sanitary sewer leakage into a storm drain feeding into Bear Creek, Medford, Oregon, coliform counts remained in excess of federal standards and thus posed risks for contact activity. Fecal bacterial pollution in this small urban park creek was traced to a three-member raccoon family living in a catch basin. Since all efforts to trap or exclude the animals failed, it was decided to treat the creek water by suspending 1 pound of swimming pool water purification tablets in the flow from a manhole upstream of the park. These tablets are renewed weekly on Thursday or Friday. Treatment is discontinued in winter. This treatment also controls pollution from pets which defecate in the park. (Cassar-FRC)
W83-02768

CONTAMINATION OF THE MEDITERRANEAN COAST AND ITS CONTROL AS A PROBLEM OF LAND MANAGEMENT (LA CONTAMINACION LITORAL MEDITERRANEA Y SU CORRECCION COMO UN PROBLEMA DE LA ORDENACION TERRITORIAL),
Valencia Univ. (Spain).
J. J. Diez Gonzalez, and R. M. Paz Doel.
Progress in Water Technology, Vol 12, No 4, p 771-780, 1980. 9 Ref. English summary.

Descriptors: *Water pollution sources, *Coastal waters, *Coastal zone management, Seawater, Wastewater, Wastewater disposal, Water pollution control, Mediterranean Sea, Valencia, Spain.

The extent of water pollution in the coastal areas of the Mediterranean Sea and the effectiveness of simple dilution as treatment are discussed. Decreases in fish catches in the Valencia region indicate that the pollution in the Mediterranean has passed the level that the sea can naturally absorb. It is necessary to investigate pollutants and their concentrations in waste discharges and seawater so that a solution such as wastewater treatment or a disposal system can be found. A coastal zone management policy that includes all areas of the sea is necessary. (Small-FRC)
W83-02777

POLYCHLORINATED BIPHENYLS IN THE SEDIMENTS OF THE INNER OSLOFJORD,
Oslo Univ. (Norway). Inst. of Marine Biology.
M. I. Abdullah, and O. Ringstad.
Water, Air, and Soil Pollution, Vol 18, No 4, p 485-497, 1982. 4 Fig, 4 Tab, 33 Ref.

Descriptors: *Polychlorinated biphenyls, *Fjords, *Sediment cores, Fate of pollutants, DDT, Pesticides, Insecticides, Chlorinated hydrocarbons, Organic compounds, Aromatic compounds, Oslo, *Norway, Organic matter.

Polychlorinated biphenyls (PCB's) and DDT were determined in sediment cores taken from the Inner Oslofjord, Norway, in 1980. Considerable industrial and domestic wastes are regularly discharged into this water, which has limited circulation and exchange. PCB concentrations were highly variable, 10-702 ng per g. Patterns were observed in 2 locations. In Bunnefjord the maximum PCB concentration was at 5 cm depth. In Vestfjord PCB levels were highest on the surface and decreased with depth. Compounds were fractionated according to chlorine content. In Bunnefjord sediments the proportion of 5 and 6-Cl compounds was constant with depth. In Westfjord sediments the proportion of 5-Cl compounds increased and 6-Cl compounds decreased with depth. The fraction of 7 and 8-Cl compounds remained constant throughout the area. Total DDT (metabolites found in all cores but 1) in sediments ranged from none detected to 978 ng per g. PCB levels were relatively uniform, considering the presence of waste outfalls. This is apparently a result of PCB association with organic matter and aquatic life and subsequent redistribution and bioperturbation, as illustrated by the sediment profiles at Bunnefjord approximately reflect the history of use and discharge of PCB's in the region. (Cassar-FRC)
W83-02783

HEAVY METALS IN WASTEWATER--ORIGINS AND SIGNIFICANCE (SCHWERMETALLE IM ABWASSER--HERKUNFT UND BEDEUTUNG),
Bundesamt fuer Umweltschutz, Bern (Switzerland). Abt. Naturwissenschaften und Fischerei.
H-P. Fahrni, and P. Ammann.
Wasser, Energie, Luft, Vol 73, No 3, p 29-31, March, 1981. 3 Tab, 10 Ref. English Summary.

Descriptors: *Heavy metals, *Sludge, *Industrial wastewater, *Municipal wastewater, *Storm wastewater, Precipitation, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Zinc, Sludge disposal, Fertilizers, Incineration, Air pollution, Pollutant identification, *Switzerland.

In the course of wastewater treatment, 1.8 million tons of sludge with 90,000 tons of dry matter are produced annually in Switzerland. This sludge contains about 6% of the phosphorus used as fertilizer in the country, but it can be utilized only if it is relatively free of heavy metals. Guidelines for heavy-metal content in sludge were laid down in 1975: they were designed for long-term fertilization with 2.5 tons dry matter/hectare/yr. Obligatory inspection of sludge in wastewater treatment plants serving > 10,000 clients has occurred since 1977 and has shown high cadmium (Cd), zinc (Zn), copper (Cu), and nickel (Ni) levels. Results of analyses of drinking water, domestic and industrial wastewater, and stormwater at treatment facilities in the Morges region on Lake Geneva showed that heavy metal content in precipitation and runoff had previously been underestimated: Cu, Fe, Mn, Pb, and Zn contents in domestic wastewater, stormwater, and runoff were far higher than those

in industrial wastewater--only 5-15% originated from galvanizing or metal-work industries. Industrial wastewater contained 30-50% of the Hg, Ni, and Cr measured. Cd originated to some extent in industrial wastewater, and to some extent in runoff (due to refuse incineration and fossil fuels). Of the Zn measured, 65% was from corrosion from water pipes, while some was found in highway runoff. Cu originated from domestic wastewater (pipes) and, to a greater extent, from runoff. More than 80% of Pb was found in street and roof runoff and in stormwater, the primary cause being leaded gasoline. Other studies have shown that soil erosion by wind, industrial air pollution, and refuse and other incineration processes produce heavy metal concentrations in precipitation that are far greater than those found in a moderately polluted river; more must be done to combat this. (Gish-FRC)
W83-02787

ESTIMATION OF THE SEWAGE LOADING OF THE MEDITERRANEAN AT THE BEACHES OF VALENCIA, SPAIN (ESTIMACION DE LA CARGA CONTAMINANTE VERTIDA AL MAR MEDITERRANEO EN EL LITORAL PROXIMO A LA CIUDAD DE VALENCIA (ESPANA)),
Sociedad d'Aguas Potables Mejoras de Valencia (Spain).
P. Marti Gallego, and J. Garcia Gomez.
Progress in Water Technology, Vol 12, No 4, p 441-454, 1981. 3 Fig, 5 Tab, 9 Ref. English summary.

Descriptors: *Bacterial analysis, *Chemical analysis, *Coastal waters, *Water pollution sources, Seawater, Wastewater, Water analysis, Agricultural wastes, Industrial wastes, Municipal wastes, Mediterranean Sea, Valencia, *Spain.

Contamination of the Mediterranean Sea by wastewater discharged from the Valencia (Spain) area was investigated. The region has changed from a primarily agricultural area to an industrial and urban center. Agricultural, industrial, and municipal wastes are discharged via an ancient complex network of canals. Water samples were collected at the mouths of the main streams discharging into the sea along the coastal zone between Carrainet creek and the new Turia river bed. Chemical and bacterial analyses were performed. Seawater in the area was also analyzed for bacterial content to study the extent of contamination by fecal matter. The observed contamination level was extremely high (BOD 22,740 metric tons total for the 6 sites tested). Chlorination of wastewater is recommended to prevent infection, especially by Salmonella, but would be expensive due to the high chlorine demand of the wastewater. (Small-FRC)
W83-02796

5C. Effects Of Pollution

QUANTIFICATION OF MECHANISMS RESPONSIBLE FOR BLUEGREEN ALGAL DOMINANCE,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 2H.
W83-02482

THE MICROBIAL DYNAMICS OF AN EPILITHIC ALGAL-BACTERIAL MAT COMMUNITY IN AN OLIGOTROPHIC, HIGH ALPINE STREAM,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W83-02490

PARAMETERS OF DETERIORATING MICROBIOLOGICAL QUALITY OF SELECTED SURFACE WATERS IN RESIDENTIAL MISSOULA, MONTANA,
Montana Univ., Missoula. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W83-02492

THE INFLUENCE OF KOKANEE SALMON AND MAN ON THE WATER QUALITY OF LOWER MCDONALD CREEK, GLACIER NATIONAL PARK, MONTANA,
Montana Univ., Missoula. School of Forestry.
G. T. Foggin, and B. R. McClelland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186478, Price codes: A04 in paper copy, A01 in microfiche. Montana Water Resources Research Center Report No 127, Bozeman, January 1983. 68 p, 10 Fig, 7 Tab, 18 Ref. OWRT A-122-MONT(1), 14-34-0001-0128.

Descriptors: *Fish, *Salmon, *Water pollution sources, *Decomposing organic matter, Annual waste, Sewage effluents, Dead fish, Carcass decomposition, Sewage irrigation, Stream pollution, Groundwater pollution, *Montana, MacDonald Creek.

Kokanee salmon (Oncorhynchus nerka) spawn each fall in lower McDonald Creek near the western boundary of Glacier National Park, northwestern Montana. This study was designed to: 1) determine the impact of salmon decomposition upon selected hydrochemical patterns in McDonald Creek; and 2) evaluate the impacts of a sewage sprayfield treatment facility and horse pasture upon selected chemical and bacteriological patterns of the creek. Streamflow and water quality relationships above Lake McDonald differed considerably from those in the spawning reach of the creek below the lake. There were no detectable increases in major ion concentrations during the 1979-1980 sampling period attributable to salmon decomposition. Nitrate-nitrogen concentrations did not increase below the salmon spawning area; however, total phosphorus exhibited a threefold increase in concentration coincident with initial carcass decomposition in late October 1980. The phosphate concentration patterns confirm fish migration as a recycling mechanism for selected critical nutrients. There is evidence of distinctive groundwater inputs from the vicinity of the sewage sprayfield into lower McDonald Creek immediately above its confluence with the Middle Fork of the Flathead River. Fecal coliform concentrations were generally less than one colony per 100 mls, except for several occasions at the downstream sampling stations during the 1979 fall season.
W83-02494

PCBS IN LAKE GENEVA (LAKE LEMAN) FISH,
Ecole Nationale Veterinaire de Lyon (France). Lab. de Toxicologie.
G. Monod, and G. Keck.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 5, p 570-576, November, 1982. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Bioaccumulation, *Fish, *DDD, *DDE, *DDT, *Polychlorinated biphenyl, Toxicity, Biomagnification, Perch, Roach, Pesticides, Halogenated pecticides, Fish eggs, Water pollution effects, Lake Leman, France, Switzerland, Gas chromatography.

Four species of fish (chars, coregonines, roaches, and perch) from Lake Leman, an important fishing lake for France and Switzerland, were analyzed for levels of DDE, DDD, DDT and polychlorinated biphenyls (PCB) by gas chromatography. There was a good correlation between PCB levels in different organs and their lipid contents when the fish were of the same species, age, and sex. In general, older fish were more contaminated than younger fish, and males were more contaminated than females. In order to make interspecies comparisons of PCB levels, the growth time of each species must be taken into account along with diet. Results of interspecies comparisons of PCB levels reflected the effects of biomagnification. PCB levels increased in the order of roaches, perches, and chars, an order consistent with their different degrees of carnivorous diet. PCB levels were lowest in coregonines, which are strict planktivores. In the present study, char eggs contained PCB levels of 14 to 22 parts per million on a lipid basis, a level consistent with high egg mortality in results from studies on other fish species. These findings may help to explain the decrease in char populations from Lake Leman in recent years. (Geiger-FRC)
W83-02513

EFFECT OF SOIL AND CONIFEROUS TREES ON SOME CHEMICAL CHARACTERISTICS OF THE WATER OF RESERVOIR LG2 (INFLUENCE DES SOLS ET ARBRES NOYES SUR QUELQUES CARACTERISTIQUES CHIMIQUES DE L'EAU DU RESERVOIR LG2),
Laval Univ., Quebec.
For primary bibliographic entry see Field 5B.
W83-02520

COOLING SYSTEMS: CAN ENGINEERS SAVE THE FISH,
Burns and Roe, Inc., Oradell, NJ. Hydraulic Engineering Dept.
For primary bibliographic entry see Field 8I.
W83-02551

THE SEASONAL VARIATION OF ORGANIC CONSTITUENTS IN A EUTROPHIC LAKE, LAKE SUWA, JAPAN. PART 1, PARTICULATE ORGANIC MATTER,
Nagoya Univ. (Japan). Water Research Inst.
T. Hamma, and N. Handa.
Archiv fur Hydrobiologie, Vol 93, No 4, p 446-465, March, 1982. 8 Fig, 1 Tab, 42 Ref.

Descriptors: *Organic matter, *Particulate matter, *Seasonal variation, Lakes, Lake Suwa, *Japan, *Eutrophic lakes, Chlorophyll a, Nitrogen compounds, Organic carbon, Carbohydrates, Protein, Algae, Phytoplankton, Cyanophyta, Diatoms, Nutrients, Water pollution effects.

Organic constituents (chlorophyll a, particualte organic carbon and nitrogen, carbohydrates, and protein) varied seasonally in Lake Suwa, a very eutrophic lake in Japan. Particulate matter was collected monthly from April 1979 to July 1980 from 0.5, 3, and 5.5 m depths. The vertical distribution was insignificant except for the summerof 1979, when levels of most organic substances were much higher at the surface than at greater depths. Chlorophyll a concentrations in surface water showed peaks during blooms of olue-green algae in July-September 1979 (120 micrograms per liter) and diatoms in March-April 1980 (60 micrograms per liter). Concentrations of other organic substances changed seasonally in the same pattern as chlorophyll a: particulate organic carbon, 0.7-11 mg C per liter; particulate organic nitrogen, 0.12-2.2 mg per liter; particualte carbohydrate, 0.22-3.5 mg per liter; and particulate protein (including amino acids and peptides), 0.70-2.7, 0.58-2.7, and 0.85-2.6 mg C per liter in water depths of 0.5, 3, and 5.5 m, respectively, with highest levels in summer and spring. Separation of the water-extractable organic substances from the particulate fraction collected in August-September revealed an accumulation of reserved polysaccharides composed largely of glucose units in the particulates. The ratio of particulates organic carbon to chlorophyll a in surface waters was 77, indicating that the diatoms and blue-green algae were actively growing cells. The ratio of particulate protein C to carbohydrate C tended to increase with an increase in concentration of total inorganic nitrogenous nutrients and decrease during algal blooms. (Cassar-FRC)
W83-02559

PESTICIDES IN GROUNDWATER: THE ALDICARB STORY IN SUFFOLK COUNTY, NY,
Suffolk County Dept. of Public Health, Hauppauge, NY.
For primary bibliographic entry see Field 5F.
W83-02560

VALUE OF INDIVIDUAL HOUSEHOLD WATER SUPPLIES IN THE MAINTENANCE PHASE OF A SCHISTOSOMIASIS CONTROL PROGRAMME IN SAINT LUCIA, AFTER CHEMOTHERAPY,
National Inst. for Medical Research, London (England). Div. of Parasitology.

For primary bibliographic entry see Field 5G.
W83-02561

EFFECTS OF NUTRIENT ENRICHMENT ON THE COLONIZATION AND DECOMPOSITON OF PLANT DETRITUS BY THE MICROBIOTA OF AN ARCTIC LAKE,
Cincinnati Univ., OH. Dept. of Biological Sciences.
T. W. Federle, V. L. McKinley, and J. R. Vestal.
Canadain Journal of Microbiology, Vol 28, No 11, p 1199-1205, 1982. 3 Fig, 2 Tab, 18 Ref.

Descriptors: *Nitrogen, *Phosphorus, *Oligotrophic lakes, *Litter, *Microbial degradation, *Detritus, *Adenosine triphosphate, Nutrients, Lakes, Rooted aquatic plants, Photosynthesis, Aquatic populations, Arctic zone, *Alaska, Toolik Lake.

The effects of nitrogen and phosphorus enrichments on the colonization and decomposition of sedge plant litter (Carex) by the microbiota of Toolik Lake, Alaska, were examined in laboratory microcosms. The addition of phosphorus caused a fourfold increase in the levels of ATP associated with the microbiota on fresh litter, while additions of nitrogen and phosphorus yielded only a twofold increase in the ATP associated with the microbiota of fresh or partially degraded litter compared with controls. The observed weight loss of fresh or partially degraded litter was not significantly affected by nitrogen or phosphorus enrichments alone or in combination. Additional phosphorus, when available, was immobilized by the litter microbiota. Further studies showed that the increase in ATP resulting from nutrient enrichment occurred only in daylight and not in the dark, suggesting nutrient stimulation of the photosynthetic component of the detrital community. (Geiger-FRC)
W83-02563

THE ECOLOGICAL CLASSIFICATION OF THE QUALITY OF SURFACE WATERS ON LAND, PRINCIPLES AND PRACTICAL EXPERIENCE,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. N. Zhukinskiy, O. P. Oksiyuk, G. N. Oleynik, and S. I. Kosheleva.
Hydrobiological Journal, Vol 17, No 2, p 22-33, 1981. 3 Tab, 34 Ref.

Descriptors: *Classification, *Water quality, *Surface water, Ecology, Ions, Mineralization, Trophic level, Physical properties, Chemical properties, Bacteria, Phytolankton, Organic matter, Indicators, Nutrients, Water pollution effects.

An updated system for classification of surface water quality is presented. It incorporates physical and chemical indicators reflecting the composition and properties of the water in terms of abiotic and biotic indicators. The general classification uses two subclassifications: (1) extent of mineralization and ionic composition and (2) ecological and public health classification. The salinity indicator is divided into freshwater (alpha and beta hypohaline and alpha and beta oligohaline), brackish water (alpha and beta mesohaline and polyhaline), and salt water (euhaline and ultrahaline). Ionic composition classifies the waters into hydrocarbonate, sulfate, and chloride, each with Ca, Mg, and Na subgroups. The ecological and public health classification divides waters into five main classes: of utmost purity, pure, of adequate purity, polluted, and dirty. Each of these is described by indicators: (1) hydrochemical (suspended solids, transparency, and color), (2) trophic indicators (hydrophysical and hydrobiological), (3) bacteriological (bacterioplankton, heterotrophic bacteria, E. coli group), and (4) biological indicators (saprobity). Since water quality is a result of the complex interaction of natural conditions and man's activities, the contribution of each cannot be easily defined. This classification system reflects the background water quality without separating the two types of effects. It is not designed to replace existing State Standards, which establish threshold values for various indicators. Rather, the classification can indicate the suitability of various waters for specified uses, such as irrigation. (Cassar-FRC)
W83-02569

NICKEL TOXICITY TO FUNGI: INFLUENCE OF ENVIRONMENTAL FACTORS,
New York Univ., NY. Lab. of Microbial Ecology.
H. Babich, and G. Stotzky.
Ecotoxicology and Environmental Safety, Vol 6, No 6, p 577-589, 1982. 13 Fig, 29 Ref.

Descriptors: *Nickel, *Toxicity, *Fungi, Water pollution effects, Metals, Heavy metals, Hydrogen ion concentration, Humic acid. Chlorophyll, Water hardness, Growth rates, Inhibition, Microorganisms.

The effects of environmental factors on nickel toxicity to filamentous fungi were determined. Statistically significant growth reduction was observed at Ni concentrations of 5 ppm for Achyla sp.; 10 ppm for Saprolegnia sp. and Cunninghamella blakesleeana; and 10 ppm for Aspergillus clavatus and A. flavus. Total inhibition of growth occurred at 50 ppm Ni for A. flavus and 50-100 ppm for the other four fungi. Increasing pH from mildly acid to neutral or alkaline eliminated Ni toxicity at concentrations of 20 ppm Ni or less. Addition of Mg or Zn (but not K, Na, Ca, or ferric) ions reduced the toxicity of 10 ppm Ni to Achyla sp. A combination of Ni and Pb was strongly antagonistic toward fungal growth, but the interactions between Ni and Cd and between Ni and Hg were less well defined. Chlorophyll, at 1%, reduced Ni toxicity toward Saprolegnia and C. blakesleeana. Increasing the chlorophyll concentration from 0.2 to 1% progressively reduced Ni toxicity to A. clavatus. Addition of 1% hymic acid reduced Ni toxicity to Saprolegnia and C. blakesleeana, and increasing humic acid levels from 0.2 to 1% progressively reduced toxicity of Ni toward A. flavus. Inhibition of A. flavus was more pronounced at 23C at 33C. (Cassar-FRC)
W83-02582

LARGE-SCALE DEVELOPMENT OF CERATAULINA BERGONII PERAG IN THE NORTHWESTERN PART OF THE BLACK SEA,
D. A. Nesterova.
Hydrobiological Journal, Vol 17, No 6, p 19-23, 1981. 2 Fig, 1 Tab, 14 Ref.

Descriptors: *Seas, *Eutrophication, *Algal growth, Nutrients, Water quality, *Black Sea, Cerataulina bergonii, Temperature effects, Seasonal variation, Algae, *USSR.

Eutrophication of the northwestern Black Sea is the major reason for large-scale development of C. bergonii, which is most abundant near the Dniester estuary. Its vertical distribution exhibits a single peak in the hyponeuston layer. Cell size, and therefore biomass, are higher in the zone of vegetative growth, whose location is a function of the degree of eutrophication. The dimensions of the cells were determined on seven samples, selected on the basis of the spatial and vertical distribution of C. bergonii. The pelagic, neritic plankton C. bergonii is widely distributed in the Black Sea. In September of 1975 the numbers were nonuniformly distributed in the northwestern area of the Sea. When the temperature on the sea surface ranged from 18.4 to 21 degrees C and there was an abundance of nutrients, an explosive growth of C. bergonii occurred. The spatial and vertical distributions of C. bergonii in the Dniester-Danube interfluve were controlled by the nutrient-carrying river flows. It was concluded that eutrophication of the coastal zones of the northwestern Black Sea led to an increase in cell volume, which was reflected in the quantity of the biomass. Thus it becomes necessary to calculate separately the average weight of the cells of one species in the sea areas with high and low vegetation of these cells. (Baker-FRC)
W83-02602

HYDROBIOLOGICAL CONDITIONS IN THE KARAKUMY CANAL,
Akademiya Nauk Turkmenskoi SSR, Ashkhabad. Inst. Botaniki.

For primary bibliographic entry see Field 4A.
W83-02625

ECOLOGICAL FOUNDATIONS OF MEASURES TO PROTECT THE HYDROSPHERE AGAINST MAN-MADE POLLUTION,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 6G.
W83-02626

BIOMASS OF MARINE MACROFAUNA COMMUNITIES IN A DUMPING AREA OF SEWAGE SLUDGE NEAR THE ELBE ESTUARY (DIE BIOMASSE MARINER MAKROBENTHOS-GESELLSCHAFTEN IM BEMUNDUNG),
Zoologisches Inst. und Museum, Hamburg (Germany, F.R.).
U. Muhlenhardt-Siegel.
Helgolander Meeresuntersuchungen, Vol 34, No 4, p 427-437, 1981. 4 Fig, 2 Tab, 20 Ref.

Descriptors: *Sludge disposal, *Microenvironment, *Environmental effects, Land disposal, Mud, Biomass, Seasonal variation, Polychaetes, Crustaceans, Echinoderms, *Federal Republic of Germany, Elbe River estuary.

The macrofauna of a dumping area in the eastern part of the German Bight (North Sea) was investigated during July, August and November of 1978 at five stations situated on a transect including central and peripheral areas of the dumping region. Abundance and biomass (ash free dry weight) of the macrofauna and its variation from July to November were analyzed as well as biomass of different taxa. Molluscs dominated over polychaetes, crustaceans and echinoderms. A positive correlation appeared between mud content and biomass at the peripherally situated stations. In the central sewage sludge area, however, the biomass values were reduced. In late autumn the biomass decreased in the entire area due to the death of Diastylis rathkei, Abra alba and Pectinaria koreni. These species were replaced by the mollusc Nucula turgida and polychaete Nephtys hombergii. In autumn the biomass values also showed a distinct minimum at the central stations. (Baker-FRC)
W83-02627

INVESTIGATIONS ON SEASONAL VARIATIONS OF SAPROBITY IN FLOWING WATER (UNTERSUCHUNGEN UBER JAHRESZEITLICHE VERANDERUNGEN DER SAPROBITAT IN EINEM FLIESSGEWASSER),
Wasserwirtschaftsdirektion Saale-Werra, Erfurt (German D.R.).
For primary bibliographic entry see Field 5B.
W83-02640

SELENIUM ACCUMULATION AND CYTOTOXICITY IN TELEOSTS FOLLOWING CHRONIC ENVIRONMENTAL EXPOSURE,
Texas Univ. at Austin. Dept. of Pharmacology.
E. M. B. Sorensen, T. L. Bauer, J. S. Bell, and C. W. Harlan.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 6, p 688-696, 1982. 4 Fig, 1 Tab, 22 Ref.

Descriptors: *Selenium, *Sunfish, *Regression analysis, *Water pollution effects, Reservoirs, *Tissue analysis, Fish, Fish physiology, Fish toxins, Histology, Ecological effects, Industrial wastes, Lakes, Metabolism, Fate of pollutants.

Fish of the Centrarchidae family, green sunfish and redear sunfish, were collected from four sites of Martin Lake, a reservoir that was subject to selenium (Se) pollution from systems used to collect fly ash, scrubber ash and bottom ash. Cytologic examinations, hematocrit determinations and neutron activation analysis were performed on selected fish tissues. Linear regression of Se concentration in skeletal muscle on Se concentration in the hepatopancreas of redear sunfish from two sites in the reservoir showed that a highly significant correla-

tion exists between Se levels in these two tissues. All redear sunfish muscle samples from fish collected near a recognized Se discharge site were well above the 2 ppm level. Regardless of species, more Se was detected in sunfish from Martin Lake than in fish collected from reference lakes used in this study. Green sunfish appeared to be edematous from both condition factor data and organ data. Histological studies showed abnormalities of the exocrine pancreas, ovaries, mesonephros, gill lamellae and myocardium in Se exposed fish. Changes in the hepatopancreas, mesonephros and ovaries were similar for both redear and green sunfish, while reactions of the other affected tissues to Se exposure differed in these two species. (Geiger-FRC)
W83-02659

HEMOGLOBIN-GLUTATHIONE RELATIONSHIPS IN TROUT ERYTHROCYTES TREATED WITH MONOCHLORAMINE,
Seattle Metro Water Quality Lab., WA.
J. A. Buckley.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 6, p 637-644, 1982. 5 Fig, 18 Ref.

Descriptors: *Trout, *Disinfectants, *Hemoglobin, *Monochloramine, Fish, Fish physiology, Water pollution effects, Oxidation, Disinfection, Blood, Regression analysis.

The relationship between hemoglobin and reduced glutathione (GSH) in trout erythrocytes treated with monochloramine, a widely used drinking water and wastewater disinfectant, was examined in laboratory tests. In human erythrocytes in vitro, monochloramine has been shown to inhibit the hexose monophosphate shunt activity critical to maintaining glutathione in the reduced form. Preparations of trout erythrocytes exposed to monochloramine and control preparations were analyzed for recovery of hemoglobin and GSH after various incubation periods. Regression equations were used to calculate the percentage of GSH remaining after monochloramine treatment, along with the pecentage of sulfhemoglobin and methemoglobin formed. Results showed that the reaction of GSH was approximately equimolar with the initial concentration of monochloramine. The empirically derived equation for the oxidation of hemoglobin and depletion of GSH by monochloramine in rainbow trout erythrocytes provides a quantitative basis for examining the relationships between reactants and products during rapid oxidative changes. The production of sulfhemoglobin prior to complete methemoglobin formation may be due to incomplete oxidation, resulting in a mixture of tetramers at all stages of heme oxidation. (Geiger-FRC)
W83-02660

THE POPULATIONS, CHARACTERIZATION AND ACTIVITY OF SUSPENDED BACTERIA IN THE WELSH RIVER DEE,
University Coll., Galway (Ireland). Dept. of Microbioloby.
For primary bibliographic entry see Field 5B.
W83-02707

FEASIBILITY OF INACTIVATING PHOSPHORUS WITH ALUMINUM SALTS IN BALL POND, CT,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5G.
W83-02718

AQUATIC HABITAT PROGRAM PLAN FOR ASSESSING THE EFFECTS OF POLLUTANTS IN THE SAN FRANCISCO BAY-DELTA ESTUARY,
California State Water Resources Control Board, Sacramento.
G. E. Johns, and R. Bachman.
Publication No 82-7SP, October 1982. 49 p, 19 Fig, 14 Tab, 158 Ref, 6 Append.

Descriptors: *Monitoring, *Water quality standards, Water quality, Pollutants, *Effluents, Bays, Water pollution sources, Wastewater management, Cost-benefit analysis, Water pollution control, *Aquatic life, Hydrodynamics, Model studies, *California, San Francisco Bay-Delta estuary.

This Plan is the State Water Resources Control Board's attempt to make water quality monitoring of pollutants in this water body comprehensive, coordinated and cost-effective. Pollutants in the Bay affect indigenous organisms directly or combined with other pollutants, and flow patterns are complex; thus, the usual chemical analyses are inadequate. The Plan has two main concepts: using several types of biota to monitor pollutant effects, since normal appearances and physiological responses would show acceptable pollution levels; and developing a hydrodynamic model to predict movement of wastewater plumes. These concepts are considered in the Plan's six elements. The Regional Effects Element will monitor discharge effects which cannot be measured near release sites because the effects occur later and at a distance from the sites; long-term changes in the biota are assessed. The Local Effects Element will isolate specific sources of changes, and are short-term studies carried out near significant discharges. Effluent Assessment will identify specific constituents of effluents causing adverse affects to test organisms. The Hydrodynamic Element would be a vital link between basinwide regional effects and local pollution sources using existing data to create a composite model. The Coordination Element is needed to maximize the acquisition and dessemination of reliable water quality information in a cost-effective manner. The Research and Special Studies Element will provide flexibility in dealing with the unexpected, a way to understand the processes affecting the uptake of pollutants by plants and animals, and the mechanism regulating interaction between organisms and their environment. (Atkins-Omniplan)
W83-02721

THE SEPARATION OF THERMAL AND CHEMICAL EFFECTS IN EVALUATING GEOTHERMAL INFLUENCES ON AQUATIC BIOTA,
California Univ., Berkeley. Div. of Entomology and Parasitology.
V. H. Resh, G. A. Lamberti, E. P. McElravy, and J. R. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191908, Price codes: A04 in paper copy, A01 in microfiche. California Water Resources Center Completion Report, Univ. of California, Davis, March 1983. 55 p, 8 Fig, 49 Ref. OWRT-A-084-CAL(1).

Descriptors: *Geothermal studies, *Geyers, *Thermal springs, Thermal stress, Thermal powerplants, Thermal pollution, Thermal water, Chemical composition, *Chemical degradation, Benthic fauna, Aquatic life, Macroinvertebrates, *California, Big Sulphur Creek, Geyers Creek.

In this study a field based, stream microcosm system to experimentally separate the effects of the thermal and chemical components of geothermal fluids on the benthic community was developed. Using this system the separate and combined influences of these components on the numerical abundance of bacteria, the standing crop and productivity of algae, and the density, standing stock, and community structure of macroinvertebrates were evaluated. This microcosm study was designed on the basis of the results from an instream study, which was a natural comparison of benthic communities in geothermaliy influenced and uninfluenced stream segments. Additionally, a new type of field experiment to determine the upper lethal temperature thresholds for three insect species found in a geothermally influenced stream was developed. This heat shock experiment simulated acute thermal effects on organisms that drift into the lethal temperature zones that seasonally occur in geothermal streams. It also mimicked the effects of heated effluents on aquatic organisms that are drawn into the cooling water intake of a power plant, or entrained in the discharge plume. Although the instream study demonstrated that a moderate addition of geothermal fluids into a non-geothermal stream could substantially alter the structure of the benthic community, the analysis did not establish the cause of the alteration. The stream microcosm study demonstrated that the thermal component of those geothermal fluids had greater influence than the chemical component in determining the structure of the benthic community. (Synder, California)
W83-02738

CADMIUM FATE IN BACTERIAL MICROCOSMS,
Liege Univ. (Belgium). Dept. of Botany.
J. Remacle, C. Houba, and J. Ninane.
Water, Air, and Soil Pollution, Vol 18, No 4, p 455-465, 1982. 8 Fig, 5 Tab, 19 Ref.

Descriptors: *Cadmium, *Bacteria, *Accumulation, *Fate of pollutants, Water pollution effects, Bioaccumulation, *Productivity.

Cultures of a river bacterial community were exposed ot 0.5 mg per liter Cd at 10 and 20C at high and low levels of bacterial productivity. At 20C the population rapidly reached productivity levels around the control value. At 10C productivity was reduced to about 50% of control values by Cd contamination. At 20C Cd accumulation by bacteria was controlled by bacterial productivity. At low productivities, for example 2.4 mg per liter per hour, Cd accumulation in bacteria was 1288 mg per kg (dry weight) bacteria. Only 20% of available Cd was attached to cells. However, at high productivities (301.4 mg per liter per hour) 341 mg Cd per kg bacteria accumulated and 86% of Cd was associated with cells. The calculated binding capacity was 1540 mg Cd per kg. About 90% of the accumulated Cd was located in the wall-membrane fraction of both Cd-resistant and Cd-sensitive cells. Cd concentrations in bacteria decreased more slowly than theoretical calculations indicated. It was assumed that the reason for this lag was release of Cd from the bacteria attached to the wall of the vessel and subsequent uptake by free bacteria. (Cassar-FRC)
W83-02764

THE EFFECTS OF LIMNOLOGICAL PROCESSES ON THE QUALITY OF IMPOUNDED WATERS (AUSWIKUNGEN LIMNOLOGISCHER VORGANGE AUF DIE BESCHAFFENHEIT VON STAUGEWASSERN),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
For primary bibliographic entry see Field 2H.
W83-02784

5D. Waste Treatment Processes

EFFLUENT LIMITATIONS BASED ON WATER QUALITY,
Delaware State Dept. of Natural Resources and Environmental Control, Dover. Water Resources Section.
For primary bibliographic entry see Field 5E.
W83-02466

THE EFFECT OF CHLORINE DIOXIDE SUBSTITUTION IN THE FIRST STAGE OF PULP BLEACHING ON BLEACH PLANT EFFLUENT BOD,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. W. Reeve.
Pulp and Paper Canada, Vol 82, No 10, p 78-80, October, 1981. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Chlorine dioxide, *Bleaching, *Kraft mills, *Pulp wastes, *Effluents, Chlorine, Industrial wastes, *Wastewater treatment, Chemical oxygen demand, Carbohydrates.

In the first stage of bleaching of softwood and hardwood kraft pulps using chlorine dioxide substitution for chlorine, most investigators have found a modest decrease in effluent biological oxygen demand (BOD). Voss et al. (1979) found an increase in bleach plant BOD on switching to chlorine dioxide due to an increase in the extraction

stage BOD, while the first stage BOD remained relatively constant. In contrast, other researchers have found more first stage material dissolved on use of chlorine dioxide with a higher molecular weight of the material dissolved, a factor which would mitigate against greater biodegradability particularly in the second stage. Extensive mill experience has shown that it is possible to achieve only 14 kilograms BOD/ton of pulp including the contributions from black liquor carried into the bleach plant and from all bleaching stages. Increased yield of bleached pulp with increased use of chlorine dioxide has been reported and is suggested to be due to decreased carbohydrate degradation by chlorine, leading to decreased dissolution of carbohydrates, particularly in the second stage. (Geiger-FRC)
W83-02469

MAXIMIZING AQUACULTURAL POTENTIAL IN MUNICIPAL WASTEWATER PONDS,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 3C.
W83-02485

SIDESTREAM TREATMENT OF HIGH SILICA COOLING WATER AND REVERSE OSMOSIS DESALINATION IN GEOTHERMAL POWER GENERATION,
Permutit Co., Inc., Paramus, NJ.
For primary bibliographic entry see Field 3A.
W83-02486

OZONALYSIS FOR WATER REUSE APPLICATIONS,
Vanderbilt Univ., Nashville, TN. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5F.
W83-02498

THE EXPANSION OF THE USTER WASTEWATER TREATMENT FACILITY--FOURTH TREATMENT STAGE--WASTEWATER FILTRATION FACILITY (DIE ERWEITERUNG DER KLARANLAGE USTER, 4. REINIGUNGSSTUFFE, ABWASSWERFILTRATIONSANLAGE).
Wasser, Energie, Luft, Vol 74, No 1/2, p 7-11, January/February 1982. 9 Fig. (No English Summary).

Descriptors: *Wastewater facilities, *Construction, *Flocculation, *Filtration, *Phosphorus removal, Eutrophic lakes, *Wastewater treatment, *Switzerland, Uster, Greifensee, Gravity filters, Municipal wastewater, Construction costs.

The addition of a wastewater filtration facility to the existing three stage plant (mechanical, biological, simultaneous phosphate precipitation) at Uster on the Greifensee in Switzerland is described. The construction of the facility was rendered necessary by the ever-increasing eutrophication of the lake. The existing facility removed 80-90% of phosphate from wastewater to a residual of approximately 1 mg total phosphorus/l, while it was projected that the filtration plant would reduce phosphorus a further 80%, to a residual of 0.2 mg/l. Flocculation-filtration was the method of choice. The filtration facility consisted essentially of a raw water pumping station with two worm-driven pumps and eight open gravity filters. The 2-m-thick filter material was composed of a lower layer of quartz sand and an upper, coarser layer with a smaller specific gravity. Peripheral elements of the plant included the chemical dosing station, the backwash aggregate and the switching and control stations. The addition of chemicals (iron sulfate and a flocculating agent) caused flocculation of dissolved phosphates, which could then be trapped in the filter. With the facility operating at full capacity, daily phosphate discharge into the Greifensee could be reduced from 9.8 tons/yr to 2.0 tons/yr. The choice of site and site-specific construction requirements are discussed. The cost of the facility was projected at 5.38 million Swiss francs in 1979. (Gish-FRC)
W83-02503

WASTEWATER SLUDGE DISINFECTION WITH GAMMA-RAYS: AN OVERVIEW (KLARSCHLAMMHYGIENISIERUNG MIT GAMMA-STRAHLEN: EIN UBERBLICK),
Sulzer Bros. Ltd., Winterthur (Switzerland).
H. Herrnhut.
Wasser, Energie, Luft, Vol 74, No 1/2, p 21, January/February, 1982. 1 Fig, 2 Ref. (No English Summary).

Descriptors: *Disinfection, *Sludge, *Gamma radiation, *Wastewater treatment, Pathogens, Enteric bacteria, *Federal Republic of Germany, Radiation, Agriculture, Fertilizers, Sludge thickening, Energy sources, Cobalt radioisotopes, Wastewater treatment facilities.

The Sulzer gamma-radiation facility for the disinfection of sludge to be used for agricultural purposes at Geiselbulach (Federal Republic of Germany) is described. The facility has operated since 1973 and treats anaerobically stabilized sludge. The sludge is loaded into an above-ground silo (5.6 cu m capacity), then lowered into the radiation shaft, where it is rotated by means of pumps and thereby passes in front of the radiation source several times. Studies have shown that a dose (i.e., energy absorbed in the material) of 3,000 Gray (or 300 kilorads = 3 kilojoules/kg) is sufficient to eliminate pathogens. The dose, together with the activity of the radioactive source, determine the irradiation time. Cobalt-60 radiation sources are housed in the double walls of a central pipe in the radiation shaft and are cooled constantly by water with a separate circulation. Radiation with 3,000 Gray results in an average reduction of total bacteria and of enterococci by 2 orders of magnitude and of enterobacteriaceae by 5 orders of magnitude. Fecal bacteria and salmonella concentrations do not increase during sludge thickening in dry beds, but are instead further reduced with long storage times. Settling and thickening properties improve after irradiation; in a few days, dry matter content increases from 4 to 8-10%. Irradiated sludge is highly effective when used as a fertilizer: in field studies, sludge fertilization resulted in an up to 20% higher corn yield than full mineral fertilization. A simple synergism can be achieved by a combination of radiation and oxygen treatment, thereby reducing radiation dose and costs. (Gish-FRC)
W83-02505

THICKENING AND BIOLOGICAL DISINFECTION OF WASTEWATER SLUDGE BY SUBMERSED ROTATION AERATION (EINDICKUNG UND BIOLOGISCHE ENTSEUCHUNG VON ABWASSERSCHLAMM DURCH SUBMERSE UMWALZBELUFTUNG),
Mangold A.G., Basel (Switzerland).
F. Popel, and S. Mangold.
Wasser, Energie, Luft, Vol 74, No 1/2, p 16-18, January/February, 1982. 2 Fig. (No English Summary).

Descriptors: *Biological wastewater treatment, *Sludge thickening, *Disinfection, *Aeration, Aerators, *Wastewater treatment, Energy, Heating, Pathogenic bacteria, Organic matter.

Sludge thickening by flotation and disinfection and disinfection by submersed rotation aeration present energy efficient and effective alternatives to conventional methods. Wastewater sludge can be thickened in a shorter time than by gravity thickening by the introduction of small air bubbles, which results in a solids-rich foam in which 6-10% of sludge solids content is floated out. This procedure is conducted in a flotation thickener with a pear-shaped floor plan in which flotation air is introduced by an underwater rotating aerator of a size such that 50-80 Watts of drive power is exercised on 1 cu m of usable tank content. The foam rises to the surface over a sloping skimmer weir, after which a skimmer facilitates the escape of air bubbles and pushes it into the disinfection tank. Thickened sludge with a high organic content can be disinfected by the addition of oxygen and simultaneous rotation of the entire tank contents by an underwater rotating aerator. This procedure causes exothermic biochemical reactions in the substrate that provide good conditions for eliminating all pathogenic organisms as well as the risk of reinfection. It also leads to autoheating of the sludge (to 40-50C when an average of 8.4 kilo-Watt hours is used to disinfect 1 cu m of sludge) and an increase in its pH (to 8-8.5 under the same conditions). This provides for subsequent digestion temperatures of 35-37C without the need for an outside energy source. This method allows the biological disinfection of sludge in 5-9 days. (Gish-FRC)
W83-02506

A PROCESS FOR THE BIOLOGICAL DISINFECTION OF SLUDGE (EIN VERFAHREN ZUR BIOLOGISCHEN HYGIENISIERUNG VON KLARSCHLAMM),
Cetec-Engineering A.G., Turgi (Switzerland).
R. Schweri.
Wasser, Energie, Luft, Vol 74, No 1/2, p 19-20, January/February, 1982. 4 Fig, 5 Ref. (No English Summary).

Descriptors: *Sludge digestion, *Wastewater treatment, *Disinfection, *Biological treatment, *Aerobic conditions, Anaerobic conditions, Anaerobic digestion, Pasteurization, Wastewater treatment facilities, Construction, Costs, Sludge disposal.

The Cetec biothermal process for the disinfection of sludge to be used for agriculture is described. The process is designed to eliminate some of the problems of convertional thermal pasteurization, in which almost all microorganisms are killed so that the sludge possesses no resistance against reinfection, in which crusts are easily formed on heat exchangers, and in which complicated controls (usually only possible in large facilities) are required to avoid wastage. The biothermal process accelerates a natural process and consists of aerobic-thermophilic disinfection followed by anaerobic digestion that can be conducted at high temperatures. The first, aerobic stage lasts 2.5-3.5 days, with at least 12 hours at a temperature of > 50C. Heat is produced by aerobic microorganisms utilizing available heat and is intensified by the use of aerators. Oxygen utilization can be as much as 90%. The second stage is to be conducted at the highest possible temperature. The warm, pretreated sludge is not cooled before treatment. New digestion towers may be built as efficient process reactors. Smaller (and cheaper) digestion tanks can be used, as the digestion process is complete in only 10-12 days. A heating system is not required, and all gas produced in the digestion tower can be used for purposes other than heating the sludge. Experience with this process has been good so far, and the method can be used in both large and small wastewater treatment facilities. (Gish-FRC)
W83-02507

ELECTROFLOTATION PURIFIES CHEMICAL WASTEWATER (ELEKTROFLOTATION REINIGT CHEMIEABWASSER),
Wasser, Luft, und Betrieb, Vol 26, No 4, p 18, 1982. 2 Ref. (No English Summary).

Descriptors: *Chemical wastewater, *Flotation, *Flocculation, *Wastewater treatment facilities, *Secondary wastewater treatment, Sludge, Wastewater treatment, Sludge dewatering, Energy, Construction costs, *Federal Republic of Germany, *Electroflotation.

Electroflotation is used as the second stage in wastewater treatment facility at a petro-chemical plant in the Federal Republic of Germany. Electroflotation was chosen to supplement the original gravity wastewater treatment facility when it was realized that conventional settling would not be effective, because the pollutants to be removed were lighter than water. Conventionl flotation methods are energy-intensive and difficult to control, and the size of the air bubbles is unpredictable (often resulting in 'boiling' of polluted water and destruction of the flocs). Electroflotation avoids this, as gas bubbles are produced on the floor of the treatment basin in a consistently tiny size by electrolysis of water on electrodes. Water is pumped through a dosing channel with a specific throughput time; here flocculation by means of metal salts and pH conditioning occur. Optimal precipitation of metal hydroxides follows in a

slightly turbulent reaction tank by the addition of flocculating agents (polyelectrolytes). The treated and neutralized water is separated from the sludge by electroflotation. The sludge is periodically removed by pneumatic suction; the gas-containing floating sludge reaches a few centimeters above the water line and is thus partially dewatered. The advantages of this procedure include optimal pollutant removal, low chemical and energy requirements, short treatment time, compact construction, and flexible operation. The cost of the facility described was 1.5 million DM. The system was housed in a single building and was automatically monitored and shut down in the case of substandard treatment. (Gish-FRC)
W83-02508

WATER DISINFECTION WITH THE HYDROGEN PEROXIDE-ASCORBIC ACID-COPPER(II) SYSTEM,
Alexandria Univ. (Egypt). Dept. of Soil and Water Services.
N. J. Ragab-Depre.
Applied and Environmental Microbiology, Vol 44, No 3, p 555-560, September, 1982. 1 Fig, 4 Tab, 18 Ref.

Descriptors: *Disinfection, *Bacteria, Water treatment, *Hydrogen peroxide, *Ascorbic acid, *Copper, Streptococci, Clostridium perfringens, Yeasts, Molds, *Wastewater treatment.

The study of the bactericidal effects of a ternary disinfectant system is reported. The treatment of secondary effluents with hydrogen peroxide-ascorbic acid-copper(II) for 60 min resulted in about 99% reduction of the initial plate count. Hydrogen peroxide could be replaced by other peroxygen compounds; ascorbic acid could be replaced by other reducing compounds, of which sodium sulfite and ethanol were most effective. Copper, however, could not be replaced by other metals without loss of bactericidal efficiency of the ternary combination. Enterobacteriaceae, total and fecal coliforms, staphylococci, and micrococci were reduced by 99.0 to 99.9%. Group D streptococci and aerobic spores were reduced by 80 and 15%, respectively. Clostridium perfringens, yeasts and molds were not killed by the disinfectant combination. The effect of pH was minor in the range from 6 to 7.5. At a higher pH value the bactericidal effects tended to decrease. The hydrogen peroxide-ascorbic acid-copper combination made it possible to obtain 99% reductions in 30 min. Copper combined with an intermediate product of the ascorbic acid autoxidation is the toxic agent, and its penetration into the cell is promoted by hydrogen peroxide. (Baker-FRC)
W83-02511

INTERACTIONS BETWEEN AMINO-ACID-DEGRADING BACTERIA AND METHANOGENIC BACTERIA IN ANAEROBIC DIGESTION,
Tokyo Univ. (Japan). Dept. of Urban Engineering.
M. Nagase, and T. Matsuo.
Biotechnology and Bioengineering, Vol 24, No 10, p 2227-2239, October, 1982. 8 Fig, 3 Tab, 12 Ref.

Descriptors: *Anaerobic digestion, *Bacteria, *Wastewater treatment, *Amino acids, Chemical reactions, Hydrogen ions, Degradation, Biodegradation, Organic compounds, Methanogenic bacteria.

The degradation of amino acids in anaerobic digestion was examined in terms of the interactions between amino-acid-degrading bacteria and methanogenic bacteria. Certain amino acids were degraded oxidatively by dehydrogenation, with methanogenic bacteria acting as hydrogen acceptors. The inhibition of methanogenesis by chloroform also inhibited the degradation of these amino acids and/or caused variations in the composition of volatile acids produced from them. The presence of glycine reduced the inhibitory effect of chloroform, probably because glycine acted as a hydrogen acceptor in place of methanogenic bacteria. This fact suggested that the coupled oxidation-reduction reactions between two amino acids - one acting as the hydrogen donor and the other acting as the hydrogen acceptor - may occur in the anaerobic digestion of proteins or amino-acid mixtures. The conversion of some proteins to volatile acids was not affected when methanogenesis was inhibited by chloroform. This suggested that the component amino acids of proteins may be degraded by the coupled oxidation/reduction reactions and that the degradation of proteins may not be dependent on the activity of methanogenic bacteria as hydrogen acceptors. (Baker-FRC)
W83-02515

ORGANIC CHEMICAL FIRE IN ILLINOIS: EMERGENCY RESPONSE AND CLEANUP,
Illinois State Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 5G.
W83-02516

ORGANIC CARBON REMOVAL BY ADVANCED WASTE WATER TREATMENT PROCESSES,
Washington Univ., Seattle. Dept. of Environmental Health.
F. B. DeWalle, W. G. Light, and E. S. K. Chian.
Environmental Science and Technology, Vol 16, No 11, p 741-746, November, 1982. 4 Fig, 3 Tab, 26 Ref.

Descriptors: *Reverse osmosis, *Organic carbon, *Oxidation, Wastewater treatment, *Advanced wastewater treatment, Tertiary wastewater treatment, Ozonation, Hydrogen peroxide, Ultraviolet radiation, Ion exchange, Ferrates, Persulfates, Perborates, Pemanganates.

Reverse osmosis at an 85% permeate recovery removed more organic carbon (> 90%) from advanced wastewater treatment effluents (with about 5 mg per liter total organic carbon) than other processes and combinations of processes tested. There was no difference in organic removal between reverse osmosis alone and reverse osmosis before or after activated carbon treatment. Polyamide hollow fiber membranes were more effective than cellulose acetate membranes. A 700-fold excess of ozone and ozone/ultraviolet treatment removed 65% and 77%, respectively, of the organic carbon. Organic removal with hydrogen peroxide was 94% at a 40,000 mg per liter dose and 0.3% at 40 mg per liter. Results using hydrogen peroxide/ultraviolet and hydrogen peroxide with 10 mg per liter Fe catalyst were no different than using hydrogen peroxide alone. Ultraviolet alone did not reduce organic carbon levels. Evaluation of other processes produced poor to moderate carbon removals. These were: ion exchange, ozone/activated carbon, hydrogen peroxide/ultraviolet plus activated carbon, ferrate, persulfate, perborate, and permanganate. (Cassar-FRC)
W83-02528

INDUSTRIAL EFFLUENT CONTROL EXPERIENCE,
Thames Water Authority (England). Northern Div.
P. Brindley, D. C. Carter, and M. J. Linsmith.
Effluent and Water Treatment Journal, Vol 22, No 8, p 303-307, 310, August, 1982. 2 Fig, 5 Tab, 2 Ref.

Descriptors: *Industrial wastes, *Wastewater treatment, Heavy metals, Sludge, Acidity, Oils, Dissloved solids.

Examples of industrial effluent control procedures are described as applied to industrial waste treatment, persistent organic chemicals and toxic metals. Due to the difficulty of removing diluted pollutants the methods employed relate to control at source, supported by monitoring and information storage to define the input-output equation for the particular substances. Thus effort is directed at preventing the effects of waste treatment from becoming irreversibly damaging to the environment. Particular information if given on a plant designed to deal with five main recognizable groups of waste: free non-volatile oils; emulsified oils; acidic waste with a pH value below 4.0 and possibly containing metallic contaminant in the form of soluble salts; miscellaneous wastes which have some solids in suspension and mild acidity; and sludges normally neutral, but containing more than 2% settleable solids. Treatment for each waste type is briefly discussed along with catchment quality control. Limits set on industrial effluents are cited. (Baker-FRC)
W83-02530

FIELD PERFORMANCE OF RBC'S.
Water Research Centre, Stevenage (England).
E. B. Pike, C. H. Carlton-Smith, R. H. Evans, and D. W. Harrington.
Effluent and Water Treatment Journal, Vol 22, No 9, p 342, 344-345, 347-354, September, 1982. 4 Fig, 7 Tab, 57 Ref.

Descriptors: *Wastewater treatment, *Rotating biological contactors, Oxidation, Biological films, Pollutants, Literature review, Industrial wastes.

The Water Research Centre's program of investigation of the performance of rotating biological contactors (RBC) was extended in 1975-78 to study factors affecting the performance of commercial units installed at sewage works and to study the variability in composition of sewage and of effluents. Specific factors adversely affecting performance at the village works were organic overloading and mixing of liquors between treatment units. Hydraulic overloading by infiltration had little effect at one site. The effect of organic loading rate was not clear, as it was confounded by differences in design. Sets of data for composition of sewage and effluents were distributed about log-normally, andfor sets of samples taken throughout treatment, the variance of BOD and suspended solids was related to the arithmetic mean by a power law. It is suggested that this relationship may be general and could be used to calculate percentile values for any given mean value of effluent quality. Performance and rates of treatment given by the 30-population-equivalent unit were greater on the average and sludge production was lower in the year when flow varied over a diurnal cycle than in the previous year of operation with steady flow at the same average rate, although the average strength of the settled sewage was greater in the second year. (Baker-FRC)
W83-02533

MUTAGENICITY OF SRC-II COAL LIQUEFACTION WASTEWATER TREATMENT RESIDUES,
Pittsburgh Univ., PA. Graduate School of Public Health.
G. Keleti, J. Bern, M. A. Shapiro, W. P. Gulledge, and G. T. Moore.
Environmental Science and Technology, Vol 16, No 11, p 826-830, November, 1982. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Mutagens, *Coal liquefaction, *Sludge, Fate of pollutants, Wastewater treatment, Sludge digestion, Carcinogens, Organic compounds, Polycyclic aromatic hydrocarbons, Aromatic compounds.

Sludge from an SRC-II coal liquefaction wastewater treatment plant and a solid waste (vacuum bottoms) exhibited some mutagenicity as determined by the Ames Salmonella/microsome test. Two sample sets of these substances were tested as a whole and as hexane, toluene, methylene chloride, and acetonitrile fractions. Vacuum bottoms in both sample sets had the highest mutagenic activity, 2875 and 11,095 revertants per mg. Mutagenic activities (in revertants per mg) of wastewater treatment sludges were: alum sludge, 7705; clarifier sludge, 4.050 and 0.932; and digester sludge, 0.530 and 1.273. Mutagenicity varied between the two sample sets and with type of sludge. This was evident in results from solvent fractionation. Clarifier sludge (fresh) and its four fractions were more mutagenic than digested sludge (aged). Digestion of the sludge greatly reduced mutagenic activity in the methylene chloride and acetonitrile fractions, slightly reduced activity in the hexane fraction, and did not reduce activity in the toluene fraction. The bulk of the polycyclic aromatic hydrocarbons are in the toluene and hexane fractions.

The polycyclic aromatic hydrocarbons present in the methylene chloride and acetonitrile fractions were apparently amenable to oxidative metabolism. (Cassar-FRC)
W83-02564

AEROBIC THERMOPHILIC DIGESTION OF SEWAGE SLUDGE,
Welsh Water Authority, Powys (Wales). Directorate of Scientific Services.
For primary bibliographic entry see Field 5E.
W83-02568

THE REMOVAL OF NITRILOTRIACETIC ACID AND ITS EFFECT ON METAL REMOVAL DURING BIOLOGICAL SEWAGE TREATMENT: PART I - ADSORPTION AND ACCLIMATISATION,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
A. C. Rossin, R. Perry, and J. N. Lester.
Environmental Pollution, Series A, Vol 29, No 4, p 271-302, December, 1982. 8 Fig, 9 Tab, 52 Ref.

Descriptors: *Wastewater treatment, *Heavy metals, *Metals, *Nitrilotriacetic acid, Wastewater, *Biological wastewater treatment, Municipal wastewater, Industrial wastes.

The removal of nitrilotriacetic acid during sewage treatment is principally by biodegradation. Adsorption of nitrilotriacetic acid onto mixed liquor suspended solids was typically 25%; however, this is considered to unimportant once biodegradation has begun. Prior to the commencement of biodegradation a period of acclimitization is required. It would appear that the nature of the acclimatization period is affected by a number of factors including sludge age, the influent nitrilotriacetic acid concentration and the influent heavy metal concentrations. Acclimatization was most rapid at high sludge ages, low influent nitrilotriacetic acid concentrations and low influent heavy metal concentrations. Acclimatization periods varied between 6 and 25 days. However, in one experiment at a 4-day sludge age no acclimatization was noted after 18 days. Acclimatization occurred when the sludge age was increased to 6 days. To permit the influent heavy metal concentrations to the pilot plant to be partially controlled and to achieve concentrations typical of mixed industrial and domestic sewage, a solution of heavy metals was added to the influent settled sewage in some experiments. The results of jar tests indicate that on a percentage basis these spiked heavy metals are not more readily available for chelation by nitrilotriacetic acid than the idigenous heavy metals, with the possible exception of zinc. (Baker-FRC)
W83-02579

TREATMENT OF UNUSUAL INORGANIC WASTES,
W. Campbell, and M. L. Hemming.
Effluent and Water Treatment Journal, Vol 22, No 10, p 403, 405-406, October, 1982. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Industrial wastewater, *Metals, *Chemical wastewater, Latex, Polymers, *Wastewater treatment, Zinc, Inorganic compounds, Organic wastes.

Case histories are described for treatment of several unusual industrial wastes: elastic thread latex, zinc phosphate production wastes, and photo chemicals manufacturing wastes. A latex treatment system was redesigned to alleviate operating problems. Additional coagulation and flocculation tanks were built to relieve hydraulic restriction. The old lime addition system was replaced with a 15% caustic soda dosing system. Other improvements were polyelectrolyte addition, a biofilter, an upward flow clarifier, and sludge dewatering. Final effluent discharged to the sewer contained 4100 mg per liter COD, 2050 mg per liter BOD, and 476 mg per liter suspended solids. A small zinc phosphate plant met effluent standards of < 10 mg per liter Zn and pH 6-9 by sodium carbonate precipitation of wastewater. Wastes from a photo chemicals plant were divided into three streams--solvents (held for tanker collection), ion exchange washwaters (discharged directly to sewer), and general production wastewaters, containing a variety of toxic metal ions and acids. Metal content of the effluent was reduced by precipitation of hydroxides, settlement, and final pH discharge. pH control is automatic. (Cassar-FRC)
W83-02580

ECONOMICS OF PRECIPITANT USE IN MUNICIPAL WASTEWATER TREATMENT PLANTS (WIRTSCHAFTLICHKEIT DES FALLMITTELEINSATZES IN KOMMUNALEN KLARANLAGEN),
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
U. Neis, B. Geppert, H. H. Hahn, and D. Gleisberg.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 6, p 242-250, June, 1981. 8 Fig, 5 Tab, 17 Ref.

Descriptors: *Wastewater treatment, *Precipitation, *Economic factors, Cost analysis, Purification, Clarification, Water quality.

Precipitation purification is considered as a method for reduction of suspended solids, BOD and COD. A dynamic calculation procedure is used, allowing exact determination of time dependent variation of costs. Results show that waste water treatment costs with precipitation may equal those of conventional primary clarification and secondary biological treatment, especially with low cost iron-II-salts in simultaneous precipitation and in larger plants. In smaller plants cost advantages even result using more expensive trivalent salts in preprecipitation compared to conventional low load biological treatment. This is a consequence mainly of better effluent quality and hence lower waste water fees. If the precipitant is dosed temporarily only during the periods of highest pollution load about 5-10% of the total costs of continuous dosing can be saved. Increasing interest rates and decreasing flocculant costs are favorable for the application of precipitation. Restoration of an overloaded treatment plant by introduction of precipitation can be recommended temporarily at most for 15 years. At longer times immediate construction of a new plant will be more economical. (Baker-FRC)
W83-02591

OXIDATION OF IRON (II) SALTS IN MINE WATERS USING BACTERIA (EISEN (II)-SALZOXIDATION IN GRUBENWASSERN MIT BAKTERIEN),
Westfaelische Berggewerkschaftskasse, Bochum (Germany, F.R.).
U. Soboll, G. Rinder, and E. Beier.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 4, p 163-168, April, 1981. 5 Fig, 11 Ref.

Descriptors: *Oxidation, *Bacteria, Thiobacillus ferrooxidans, *Iron oxidation, Nutrients, Phosphates, Cultures, Quartz, Tuffstone, *Mine wastewaters, *Wastewater treatment.

Iron oxidation by Thiobacillus ferrooxidans was investigated in discontinuous and continuous cultures with different packing material (quartz, tuffstone). In preliminary batch tests as many bacteria as possible should be adsorbed on the packing material. It was shown that in cultures with packing material, the oxidation rate was higher than in cultures without packing material. Therefore continuous experiments were conducted only with packing material. Upon using a nutrient-poor, phosphate-free culture medium instead of a nutrient-rich culture medium, the oxidation rate was not lowered. When the concentration of ferrous iron in the feed solution and the feed rate were increased, a corresponding increase in the oxidation rate was noted. At an oxidation rate of 475 mg/l-h(Fe2+) and a concentration drop of ferrous iron from 715 to 1.7 mg/l, the retention time of the solution in the reaction tube was 1.5 hr. There was not much difference in oxidation rate in cultures with different packing materials. In continuous cultures 75% of the formed ferric iron remained in solution at pH 2.5. (Baker-FRC)
W83-02592

FLUSHING AND SHUTOFF DEVICES FOR SEWERS (SPUL- UND ABSPERRORGANE FUR ABWASSERKANALE),
Stadtentwasserungsamt, Frankfurt am Main (Germany, F.R.).
P. H. Hanitsch.
Gas- und Wasserfach: Wasser/Abwasser, Vol 123, No 7, p 356-361, July, 1982. 10 Fig.

Descriptors: *Sewer systems, *Maintenance, Cleaning, Waves, Surges, *Flushing, Equipment.

Sedimentation of solids and sand occurs in sewers with little descent. These accumulations must be removed repeatedly during operation of the sewer. The easiest method of cleaning is to flush sediments by the power of a water wave. There are special flushing devices available to produce such water waves. The larger the sewers and the smaller the descent, the more troublesome is construction and installation of flushing devices. Furthermore if there is only a small distance between sewer-head and surface, special constructions of flushing devices have to be considered. Specifics of construction and operation of several of these special flushing and accompanying shut-off devices are considered. (Baker-FRC)
W83-02619

ENGINEERS ASSESS AQUACULTURE SYSTEMS FOR WASTEWATER TREATMENT - PART II,
Cold Regions Research and Engineering Lab., Hanover, NH.
S. C. Reed, R. K. Bastian, and W. J. Jewell.
Civil Engineering (New York), Vol 52, No 11, p 51-53, November, 1982. 1 Fig.

Descriptors: *Wastewater treatment, *Aquaculture, Polycultures, Hyacinths, Duckweed, Ponds, Algae, Biological wastewater treatment.

An engineering assessment of the feasibility for routine use of aquaculture technologies for wastewater treatment is examined. The detailed assessments were conducted by six internationally recognized engineers. The use of combined systems for treatment was of primary concern. The study demonstrated that finfish were effective in providing further treatment in wastewater treatment ponds. Their major role seemed to be suspended solids control for final polishing. It did not appear that aquaculture components in combined systems can be optimized for both protein or biomass production and waste treatment in the same unit. Systems involving higher forms of animals seemed less efficient, required more land area or were more difficult to control than systems primarily based on plants. It is suggested that development of new concepts in the use of polyculture or combined systems for wastewater treatment should be encouraged. (Baker-FRC)
W83-02649

START-UP AND OPERATION OF AN OXYGEN-ACTIVATED ADVANCE WASTEWATER TREATMENT SYSTEM,
Western Lake Superior Sanitary District, Duluth, MN.
J. A. Johnson.
Journal of the Water Pollution Control Federation, Vol 53, No 4, p 451-456, April, 1981. 2 Fig, 4 Tab.

Descriptors: *Advanced wastewater treatment, *Oxygenation, *Activated sludge process, *Wastewater treatment, Lake Superior Sanitary District, Duluth, *Minnesota, Unox system, Sludge thickening, Filtration, Clarifiers.

Experiences and problems encountered during the start-up of the Western Lake Superior Sanitary District advanced wastewater treatment facility at St. Louis Bay, Duluth, Minnesota, are described. The facility, designed to treat 6948 cu m per hour of mixed municipal and industrial wastewater, uses a Unox system made of 4 parallel oxygenation trains, total volume 18,500 cu m. Here degritted wastewater is contacted with high purity oxygen through agitation. The process also features clarification, phosphorus removal, filtration through mixed media, chlorination with sulfur dioxide neu-

tralization, and post aeration. Effluent quality complies with the specified 25 mg per liter BOD, 30 mg per liter suspended solids, and 1 mg per liter total P. The cryogenic oxygen generators have functioned well since the September 1978 start-up. The grit tanks have produced a material more like primary sludge than clean, dry grit. This has caused problems, especially spillage from the conveyor and trucks. Other problems included overloading in the sludge dewatering system, unequal distribution of solids among the 4 secondary clarifiers, condensation of water and fog on the aluminum domes covering equipment, malfunctions in the mixed media filtration valve system, chlorine leaks, inexperience with the air flotation thickening units and vacuum filters, and electronic and installation difficulties with the computer control system. Average effluent quality has been 18 mg per liter BOD and 17 mg per liter total suspended solids in spite of highly variable influent (85-720 mg per liter BOD and 64-562 mg per liter suspended solids) and considerable sewer infiltration/inflow in rainy weather. (Cassar-FRC)
W83-02680

DIRECT FILTRATION: POLYMER IN BACKWASH SERVES DUAL PURPOSE,
Pratt Inst., Brooklyn, NY.
C. Yapijakis.
Journal of the American Water Works Association, Vol 74, No 8, p 426-428, August, 1982. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Pilot plants, *Polymers, *Filtration, *Polyelectrolytes, *Backwash, Electrolytes, Water treatment, Pretreatment of water, Turbidity, Sedimentation, Settleable solids, Drinking waters, Costs, New Jersey, Newark.

Pilot plant tests on the addition of anionic polyelectrolytes to backwashing water during direct filtration are described. At a Newark, New Jersey 100 mgd water treatment plant, the effect of preconditioning on initial turbidity breakthrough (ITB) was demonstrated. Nonionic polymer was added to the backwash and reduced the relative ITB duration by 50% to about 15 to 30 minutes. Jar tests indicated that increasing the polymer dose above 50 micrograms/liter should be based on minimizing turbidity breakthrough at the beginning of filter runs rather than on the polymer's effect on the settling ability of the wastewater solids. The addition of the polymer resulted in improved settling of the backwash solids. The complication and cost of adding the polymer is minimal when compared with the benefits. These benefits include possible capital and operational cost savings. (Small-FRC)
W83-02683

TREATMENT OF DRINKING WATER CONTAINING TRICHLOROETHYLENE AND RELATED INDUSTRIAL SOLVENTS,
Environmental Protection Agency, Cincinnati, OH.
O. T. Love, Jr., and R. G. Eilers.
Journal of the American Water Works Assoication, Vol 74, No 8, p 413-425, August, 1982. 22 Fig, 10 Tab, 49 Ref.

Descriptors: *Pilot plants, *Trichloroethylene, *Aeration, *Adsorption, *Organic solvents, Solvents, Water pollution, Water treatment, Activated carbon, Resins, Tetrachloroethylene, Dichloroethylene, Carbon tetrachloride, Dichloroethane.

The effectiveness of various treatment processes for the removal of trichloroethylene and related industrial solvents was evaluated in laboratory and pilot-scale studies. Pilot-scale diffused air aeration studies, pilot-scale granulated carbon and granulated synthetic resin columns, and boiling studies are described. When aeration was used to remove trichloroethylene, it and other solvents were removed. Adsorption was most effective when preceded by aeration. Boiling can remove solvents at point of use, but at least five minutes of vigorous boiling is needed. Preliminary cost estimates varied significantly with treatment process and contaminants. Estimates can only be made with thorough organic analysis and site-specific performance data. Data on the characteristics of the following compounds are given: trichloroethylene, tetrachchloroethylene, 1,1,1-trichloroethylene, cis-1,2-dichloroethylene, carbon tetrachloride, and 1,2-dichloroethane. (Small-FRC)
W83-02685

PROMOTION OF NEW TECHNOLOGIES OF WASTEWATER AND SLUDGE TREATMENT BY THE FEDERAL MINISTRY FOR RESEARCH AND TECHNOLOGY (FORDERUNG NEUER TECHNOLOGIEN DER ABWASSER- UND SCHLAMMBEHANDLUNG DURCH DAS BUNDESMINISTERIUM FUR FORSCHUNG UND TECHNOLOGIE),
Bundesministerium fuer Forschung und Technologie, Bonn-Bad Godesberg (Germany, F.R.).
E. Abel.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 5/6, p 165-166, May/June, 1981. (No English Summary).

Descriptors: *Wastewater treatment, *Sludge, *Research priorities, *Government supports, *Water supply development, Technology, Economic aspects, *Federal Republic of Germany, International commissions, United Nations, Industrial wastewater, Water pollution control, Water shortage, Government finance, Developing countries.

The aims and achievements of the Federal Republic of Germany's (FRG) promotional program, 'New Technologies for Wastewater and Sludge Treatment,' are discussed. The program was set up in 1976 by the Federal Ministry for Research and Technology (FMRT) to aid in the development of methods and procedures required to achieve the federal government's water-quality goals. Areas selected for intensified promotion were water protection and exploitation of the self-cleaning capacity of waters, treatment of industrial wastewater, wastewater-reduction techniques and circulation closure, and sludge treatment and use. Within the program, approximately 160 projects with a mean cost of approximately 135 million Dm have been carried out, about 25% by municipalities and research institutions and about 50% by industrial companies. New procedures have been developed and large demonstration plants constructed. Future research should concentrate on such subjects as techniques to be added to the so-called full biological treatment, treatment of concentrated wastewaters, reduction of energy requirements in wastewater treatment, further development of physical/chemical procedures, and treatment for recycling wastewater. Despite government spending cuts, the FMRT is prepared to finance these efforts. Research into preventive measures such as new industrial methods that produce little or no wastewaters must be promoted. (Gish-FRC)
W83-02716

EVALUATION OF BIOLOGICAL ACTIVATED CARBON INDUSTRIAL WATER REUSE,
Jacobs Engineering Group, Inc., Pasadena, CA.
M. Schwartz, R. G. Rice, and A Benedek.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191957, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, OWRT/RU-82/6, December 1982. 105 p, 35 Fig, 20 Tab, 26 Ref. OWRT C-80240-R(No 8805)(1), 14-34-0001-8805.

Descriptors: *Water reuse, *Activated carbon, *Biological treatment, *Ozonation, *Adsorption, *Biodegradation, Chemical oxygen demand, Biochemical oxygen demand, Oxygen uptake, Tertiary wastewater treatment, *Biological activated carbon filters, *Total organic carbon, Adsorption isotherms, Adsorption kinetics, Respirometry, Refinery effluent, Textile effluent, Pulp effluent, Fungicide effluent.

The Biological Activated Carbon (BAC) technology was tested for the production of reusable water, low in organics concentration, from industrial wastewater. Effluent streams from an oil refinery, a pulp mill, a textile dyeing mill, and a fungicide plant were studied. The batch-scale experimental plan used included the step-wise technique of ozonation, respirometric biodegradation, and activated carbon adsorption isotherms and kinetics. This technique simulates the individual processes comprising the BAC technology. A follow-up experimental plan included continuous-flow short column granular activated carbon (GAC) tests which simulate a BAC system. The test results showed that, relative to unit ozone dose, both ozonation and biodegration were more effective at a lower ozone dosage, in the ratio of 0.10 sub 3 to 1 TOC. The cumulative results of the ozonation and biodegradation tests showed that, except for the refinery effluent, optimum TOC reduction was obtained at the lower ozone dosage. TOC reduction in the refinery effluent increased with an increase in the ozone dose. The isotherm studies showed that the ultimate adsorption capacity of the carbon at equilibrium with the influent TOC concentration was enhanced by up to 50% when the effluents were susceptible to biodegradation. Overall analysis of the test results for each of the four industrial wastewater streams has indicated that the fungicide wastewater was not a good candidate for BAC treatment, that the oil refinery wastewater was potentially a good candidate for BAC treatment, and that only segregated streams from the pulp mill and textile dyeing mill wastewaters can be considered as candidates for BAC treatment.
W83-02742

OPTIMIZATION OF NITROGEN REMOVAL IN THE SINGLE SLUDGE ACTIVATED SLUDGE PROCESS,
Cape Town Univ. (South Africa). Dept. of Water Resources and Public Health Engineering.
A. C. Van Haandel, P. L. Dold, and G. V. R. Marais.
Water Science and Technology, Vol 14, No 6/7, p 443-461, 1982. 8 Fig, 5 Tab, 6 Ref.

Descriptors: *Wastewater treatment, *Nitrogen removal, *Activated sludge process, Sludge, Design criteria, Temperature effects, Sludge age, Chemical oxygen demand, *Optimization.

An optimization procedure is presented which allows rational selection of the process configuration and oprational parameters to achieve maximum removal of nitrogen in a single sludge N-D system, within the constraints set on the system. Under constant flow and load conditions simple and approximate but highly accurate formulae are developed to describe the N-D system. Selection of the N-D configuration is crucially influenced by the TKN/COD (influent) ratio, maximum and minimum temperatures and sludge age. In terms of these factors design charts presented which rapidly allow the best configuration and sizes of the anoxic and aerobic reactors to be selected. The maximum and minimum temperatures can be readily assessed from full-scale plants in the region and TKN/COD ratios by direct measurement. Determination of the easily biodegradable sewage fraction and the reference maximum specific growth rate of nitrifiers will preesent the greatest difficulty, as these can be determined only by process equipment. (Baker-FRC)
W83-02746

BIOLOGICAL NITRIFICATION IN AN UP FLOW FIXED BED REACTOR (UFBR),
Societe Degremont, Rueil-Malmaison (France). Dept. de Recherches Biologiques.
G. -M. Faup, A. Leprince, and M. Pannier.
Water Science and Technology, Vol 14, No 8, p 795-810, 1982. 9 Fig, 4 Tab, 10 Ref.

Descriptors: *Nitrifivation, *Model studies, *Wastewater treatment, Biological wastewater treatment, Activated sludge, Kinetics, Biomass, Nitrogen, *Ammonification, Ammonia, Municipal wastewater.

A kinetic model is described for ammonifiction and nitrification in an upflow fixed bed reactor with direct injection of air into the support material. Modeling has been based on the computation of active biomas concentration along the reactor. The tests, which extended over a period of one year and have been applied to municipal sewage after conventional treatment using activated sludge,

have shown that the filtration rate is the most important factor regarding both the overall quantity of biomass found in the system and the distribution of this biomass within the reactor. The optimum quantity of biomass is obtained with a filtration rate of about 5 cu m per sq m per hr. Under these conditions it is possible to reach active biomass concentrations 8 to 9 times higher than the ones found in conventional processes based on the use of nitrifying activated sludge. It is also clearly evidenced that ammonification will in most cases be incomplete, and this will limit the efficiency of the overall reaction of total N to nitrate. (Baker-FRC)
W83-02747

MASS-TRANSFER CHARACTERISTICS WITHIN MICROBIAL SYSTEMS,
Iwate Univ., Morioka (Japan). Dept. of Civil Engineering.
M. Onuma, and T. Omura.
Water Science and Technology, Vol 14, No 6/7, p 553-568, 1982. 16 Fig, 4 Tab, 8 Ref.

Descriptors: *Wastewater treatment, *Microbial degradation, *Mass transfer, *Diffusion coefficient, Biofilms, Viscosity, Kinetics.

The diffusion coefficient within a microbial system was determined by both diffusion and kinetic studies on the basis of Fick's model and an effectiveness factor model in order to predict the mass-transfer characteristics of this system. It was found to be dependent on the molar weight and the C/N ration of the compounds and substrates used in the diffusion study. On the other hand, the transitional film thickness from a reaction limited case to a diffusion limited one was found to be about 150 microns in a kinetic study. The observed diffusion coefficient in the diffusion study was of the same order as that of the kinetic study. (Baker-FRC)
W83-02749

THE SCALE-UP AND LIMITATION OF PHYSICAL OXYGEN TRANSFER IN ROTATING BIOLOGICAL CONTACTORS,
Polytechnic Inst. of New York, Brooklyn. Dept. of Civil and Environmental Engineering.
B. -J. Kim, and A. H. Molof.
Water Science and Technology, Vol 14, No 6/7, p 569-579, 1982. 5 Fig, 3 Tab, 15 Ref.

Descriptors: *Wastewater treatment, *Oxygen transfer, *Biological wastewater treatment, *Rotating biological contactors.

Three different sized laboratory scale Rotating Biological Contactor (RBC) units were constructed to study the controlling factors of physical oxygen transfer. Physical parameters were identified and evaluated by the volumetric oxygen transfer coefficient from non-steady state clean water tests. The controlling factor was found to be the liquid film flow rate per unit volume, and the function could be practically expressed and is given. The turbulence effect on the free water surface and subsurface volume became comparatively less significant as the disk size increased. The data indicated that the physical oxygen transfer contribution to the biological treatment oxygen requirement became less significant than oxygen transfer through other mechanisms as the disk size increased. This may be explained by a direct absorption of oxygen by the microorganisms. (Baker-FRC)
W83-02750

A NEW CONFIGURATION OF THE HIGH-LIME PROCESS WITH SLUDGE RECIRCULATION FOR MAGNESIUM RECYCLING,
Arizona Water Resources Research Center, Tucson.
E. Idelovitch, and A. M. Wachs.
Water Science and Technology, Vol 14, No 6/7, p 655-673, 1982. 9 Fig, 7 Tab, 10 Ref.

Descriptors: *Activated sludge process, *Advanced wastewater treatment, *Wastewater treatment, Sludge, Lime sludge, Magnesium recycling, *Sludge conditioning.

Laboratory experiments carried out with lime-algae sludge and low magnesium effluent showed that magnesium can be recycled in the high lime process by sludge recirculation. By mixing sludge with effluent, a pH of about 9 is achieved, which ensures partial dissolution of magnesium hydroxide to magnesium carbonate and magnesium bicarbonate. After settling of the sludge, the effluent enriched with Mg can be conveyed to lime treatment, whereas the new sludge can be dewatered more economically than the original sludge. The clarification results obtained with recycled Mg by sludge recirculation are similar to those obtained with MgCl2 and with recycled Mg by means of CO2, but lime consumption is lower, since part of the effluent alkalinity is consumed in the process of Mg dissolution. No dissolution of boron or heavy metals occurs, but part of the colloidal organic matter and phosphorus are released from the sludge. By means of simple computer programs that were prepared, it is possible to determine the total Mg concentration that can be reached by recycling, as well as to forecast the increase in the concentration of the dissolved and suspended fractions of any substance at steady state conditions. There is no danger of substances accumulating to undesirable levels in the final effluent. An economic evaluation showed that the new configuration of the high-lime process with sludge recirculation facilitates the solution of the sludge problem, eliminates the need for Mg addition from external sources, and reduces considerably the process cost. (Baker-FRC)
W83-02751

EFFECT OF DENITRIFICATION ON THE PH IN BIOFILMS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
E. Arvin, and G. H. Kristensen.
Water Science and Technology, Vol 14, No 8, p 833-848, 1982. 8 Fig, 4 Tab, 11 Ref.

Descriptors: *Denitrification, *Hydrogen ion concentration, *Biofilms, *Wastewater treatment, Nitrates, Carbon dioxide, Bicarbonates, Kinetics, Alkalinity, Diffusion coefficient.

Experiments performed in a laboratory fixed film unit (rotating drum biofilm reactor) showed that the pH's inside the biofilm were as much as 1.7 units greater than the pH's of the bulk liquid. This phenomenon was ascribed to production of alkalinity and the diffusional resistance to transport of alkalinity out of the biofilm. Greatest differences in pH were produced by a high bulk liquid pH, low alkalinity, a deep active biofilm, and small effective diffusion coefficients for bicarbonate and carbonate ions. The experimental results agreed with results from a model developed to describe the pH profile in a denitrifying biofilm. In the biofilm the average values of diffusion coefficients for nitrate, carbon dioxide, and bicarbonate were reduced to 65%, 30%, and 52%, respectively, of the values in pure water. The intrinsic reaction rate of nitrate was 0.23-0.42 g per cu m per sec. (Cassar-FRC)
W83-02752

OBTAINING SECONDARY TREATMENT WITH RBC/UNDERFLOW CLARIFIERS,
Bogert (Clinton) Associates, Fort Lee, NJ.
I. L. Bogert.
Water Science and Technology, Vol 14, No 6/7, p 429-442, 1982. 9 Fig, 3 Tab.

Descriptors: *Wastewater treatment, *Clarification, Secondary wastewater treatment, Baffles, Biological wastewater treatment, *Rotating biological contactors, New Jersey, Edgewater.

A one-year experimental program conducted at Edgewater, New Jersey evaluated the concept of providing secondary wastewater treatment through the installation of rotating biological contactors (RBCs) in modified primary sedimentation tanks. A primary tank was divided horizontally into two zones separated by an intermediate floor. Four RBCs were placed in the upper zone. The lower zone provided secondary sedimentation. High rate primary sedimentation was provided to remove grit and trash without removing substantial portions of BOD and SS. The experimental program was conducted over a full year at different loads, and appeared to provide effective secondary treatment with little difference in treatment efficiency between summer and winter conditions. The process was able to realize 30 mg/l total BOD5 and TSS or 85% total BOD5 and TSS removal, whichever provided the greater degree of treatment. Pretreatment of the raw wastewater was needed throughout the study period to remove grit, trash and floatables. Tracer analyses indicated that each RBC stage, as defined by baffle placement, behaved as a completely mixed tank. The overall organic removal efficiency was limited by oxygen availability, as determined by use of an RBC mathematical kinetic model. (Baker-FRC)
W83-02753

SIMULATION OF NITRIFICATION AND ITS DYNAMICS IN A ROTATING BIOLOGICAL CONTACTOR,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
Y. Watanabe, H. E. Bravo, and K. Nishidome.
Water Science and Technology, Vol 14, No 8, p 811-832, 1982. 21 Fig, 4 Tab, 14 Ref.

Descriptors: *Biological treatment, *Nitrification, *Kinetics, *Wastewater treatment, *Rotating biological contactors, Ammonia, Model studies, *Biofilms, Nitrous acid, Dissolved oxygen.

Nitrification in a partially submerged rotating biological contactor was simulated by computer. Several conclusions were reached. Although the ammonia and dissolved oxygen concentrations changed with the biofilm spatial position, the average mass flux to the biofilm surface was similar in model and experimental results. A pseudo-steady-state condition was established in the diffusion layer and in the biofilm with respect to the bulk liquid ammonia concentration during the transient period of operation. At very high ammonia concentrations process instability occurred as a result of substrate and product inhibition from free ammonia and nitrous acid. The model should include the tendency of the products to accumulate in the system and to poison the biofilm. (Cassar-FRC)
W83-02754

A MATHEMATICAL MODEL OF BIOLOGICAL PURIFICATION IN AERATED ACTIVATED CARBON BIOFILTERS,
Ecole Nationale Superieure de Chimie de Rennes (France).
G. Martin, A-Y. Le Roux, and P. Schulhof.
Water Science and Technology, Vol 14, No 6/7, p 599-618, 1982. 7 Fig, 2 Tab, 30 Ref.

Descriptors: *Model studies, *Purification, *Filters, *Wastewater treatment, Biofilms, Mathematical studies, Mathematical equations, Carbon biofilters, Biological treatment, *Activated carbon, Bacteria, Adsorption.

On the basis of results obtained in the laboratory and in a semi-industrial pilot plant, this paper outlines the probable mechanism of biological purification on activated carbon. It shows that with small loads, the medium's porosity plays a permanent role in the treatment of a water. The biological activity which develops on the material acts in a complementary fashion, allowing for continuous regeneration of the pores of the activated carbon. With heavy loads, there are two phases. During the first, adsorption and biological regeneration are complimentary. This phase lasts three to four hours. During the second phase, development of the biomass obstructs the occurrence of the adsorption phenomenon. Substrate is removed on the surface. This second phase lasts from 15 to 20 hr until the filter is clogged. After washing, the first phase again enters into operation. A mathematical model is presented. It describes results obtained with small and heavy loads. The model presents a good correlation between experimental and computed values, and manifests the advantage of using activated carbon when the influent to be treated contains adsorbable and biodegradable substances. (Baker-FRC)
W83-02755

THE FATE OF SOME METAL SPECIES: LEAD, CADMIUM, ZINC IN SURFACE WATER, DURING BIOLOGICAL SAND FILTRATION - EFFECT OF PREOZONATION,

Institut Pasteur de Lille, Villeneuve d'Ascq (France).
F. Erb, D. L. Delabre, J. C. Hopitault, A. Philippo, and P. Thomas.
Water Science and Technology, Vol 14, No 6/7, p 641-653, 1982. 5 Fig, 4 Tab, 21 Ref.

Descriptors: *Wastewater treatment, *Filtration, *Metals, Lead, Cadmium, Zinc, *Preozonation, Speciation, *Ozonation, Biological treatment, Humic acids, Chelation, Biological filters, Sand filters.

The elimination of the different chemical species of some toxic metals was determined. These metals include zinc, lead, and cadmium; their elimination was investigated during biological sand filtration on surface water containing humic material which is able to promote the complexation of metals. The effect of preozonation was examined. The metal speciation was realized by means of atomic absorption spectrometry and differential pulse anodic stripping voltammetry. The survey of organic matter was carried out by measuring TOC, UV absorption and fluorescence. The biological treatment of raw water is quite effective for the removal of particulate metals. The data bring out an important decrease for dissolved metals - about 50 to 60% with cadmium and lead - especially noteworthy for the labile complexed metals. The preozonation of raw water provides the redissolution of particulate cadmium and zinc, which are converted to free metals and seem then to be further eliminated by biological filtration. Ozonation appears to improve the efficiency of biological treatment, which usually gives higher yields of purification than flocculation (aluminum sulfate) in the same conditions. (Baker-FRC)
W83-02756

THE USE OF RHEOLOGY FOR SLUDGE CHARACTERIZATION,

Canada Centre for Inland Waters, Burlington (Ontario).
H. W. Campbell, and P. J. Crescuolo.
Water Science and Technology, Vol 14, No 6/7, p 475-489, 1982. 14 Fig, 1 Tab, 8 Ref.

Descriptors: *Wastewater treatment, *Sludge, *Rheology, Anaerobic digestion, Chemical analysis, Viscosity, Measuring instruments, Stress.

Rheological measurements were conducted on a variety of anaerobically digested sewage sludges to evaluate the potential use of rheology in describing the effects of chemical conditioning on the physical characteristics of sludges. The study was designed to evaluate the influence of the method of chemical conditioning on rheological measurements, to determine the response of the viscometer system to changes in the instrument variables, and to evaluate interrelationships between rheology and other physical properties. All rheological measurements were made using a coaxial rotational viscometer. Evaluation of a variety of test procedures indicated that both the method of adding chemical conditioners and the acceleration rate of the rotational viscometer could significantly alter the shape of the rheograms. A suggested methodology was identified, and selected samples were analyzed in triplicate to test the reproducibility of the procedures. Existing material models do not adequately describe the variety of flow behavior patterns observed with sewage sludge. The concepts of yield stress and apparent viscosity also have limited value. A parameter termed the instantaneous viscosity, defined as the derivative of the flow curve, is suggested as being more suitable for describing sludge behavior. The relationships between chemical conditioning, particle size distribution and applied shear were explored. As polymer addition increased, the sludge particles became more susceptible to shear breakup. The extent of particle size reduction depended on the rate of shear and the time during which the shear was maintained. (Author's abstract)
W83-02757

ROLE OF BACTERIAL EXTRACELLULAR POLYMERS IN METAL UPTAKE IN PURE BACTERIAL CULTURE AND ACTIVATED SLUDGE-I. EFFECTS OF METAL CONCENTRATION,

Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
M. J. Brown, and J. N. Lester.
Water Research, Vol 16, No 11, p 1539-1548, November, 1982. 10 Fig, 1 Tab, 27 Ref.

Descriptors: *Heavy metals, *Adsorption, *Klebsiella, Activated sludge, *Activated sludge process, *Separation techniques, *Chelating agents, Cadmium, Nickel, Manganese, Cobalt, Sewage bacteria, Polymers, Wastewater treatment, Fate of pollutants.

The amount of metal adsorbed by cells of Klebsiella aerogenes and flocs in the activated sludge process before and after extracellular polymer extraction was examined to determine the role of bacterial extracellular polymers in metal uptake. A gel filtration technique provided good separation of metals (Co, Ni, Mn, and Cd) complexed with bacterial extracellular polymers and free metal ions. The extraction of extracellular polymers from cultures of K. aerogenes and activated sludge reduced the capacity of cells and flocs to adsorb metal. The adsorption and complexation of metals by cells and extracellular polymers were fitted to Freundlich equilibrium isotherms. Saturation of activated sludge polymer binding sites occurred at 10 milligrams/liter metal additions (except for Mn), while K. aerogenes cells showed no saturation effects in the range of metal concentrations tested. At concentrations of 10 milligrams/liter for Cd, Co and Mn, precipitation may have been the main mechanism of metal removal. The more soluble metals generally displayed the lowest removals. The levels of extracellular polymers and soluble chelating agents in activated sludge may be important in affecting the removal of metals. (Geiger-FRC)
W83-02767

SUPERBUGS: BACTERIA FOR WASTEWATER TREATMENT PLANTS,

Williamsport Sanitary Authority, PA. Wastewater Div.
M. H. Gerardi.
Public Works, Vol 113, No 12, p 37-38, December, 1982. 10 Ref.

Descriptors: *Bacteria, *Organic wastes, *Biological treatment, Wastewater treatment, Sewage bacteria, Cultures, Micoorganisms, Digestion, Process control, Biosaugmentation.

The efficiency of organic wastewater treatment systems may be enhanced by adding cultures of selected or mutant bacteria. These bacterial suspensions are available from several commercial sources. They typically contain Aerobacter, Bacillus, Cellulomonas, Nitrobacter, Nitrosomonas, Pseudomonas, and Rhodopseudomonas, which degrade larger organic molecules into smaller molecules which then can be metabolized by other bacteria. To use cultures in a wastewater system, the specific conditions and problems must first be assessed and appropriate bacterial types and quantities determined. Bacteria are added daily in a water suspension (0.5-2 gal per 1 million gal raw sewaga) after the grit removal step. Improvement is generally seen in 30-90 days and lasts about 60 days after ending bacterial addition. Bioaugmentation can control foam, hydrogen sulfide, ammonia, undesirable bacteria, and odor; improve BOD and suspended solids removal, cold weather performance, digester gas production, and sludge settleability; correct a sour digester; and buffer the effects of shock and toxic loads. (Cassar-FRC)
W83-02769

WASTEWATER SYSTEM IMPROVEMENTS HELP DALLAS MEET FUTURE NEEDS,

Camp, Dresser and McKee, Inc., Dallas, TX.
W. B. Buchholz, and P. A. Roach.
Public Works, Vol 113, No 12, p 52-53, December, 1982.

Descriptors: *Activated sludge process, *Sludge digestion, *Wastewater treatment, Dallas, *Texas, Sewers, Trickling filters, Digestion, Planning.

A capital and operating improvement program for Dallas, Texas, was designed to meet needs through the year 2000. The present system includes a 115 mgd activated sludge-trickling filter plant and a 30 mgd activated sludge facility which currently treat 156 mgd. Flow in 2000 is expected to reach 195 mgd. The most economical alternative was to rehabilitate and expand the two existing plants to 210 mgd capacity. It was recommended that relief interceptors be constructed immediately to handle peak flows in critical sections. Other projected improvements were construction of relief sewers for four major interceptors, diversion of two existing interceptors to balance flow to each plant, institution of infiltration/inflow studies on a 5-year cycle, change of single-stage operation in the trickling filter plants, addition of secondary clarifiers and multimedia filters, installation of new activated sludge units with appurtenances, and gravity thickening of sludge followed by anaerobic digestion and land disposal. The use of methane gas produced in the sludge digestion process will save about $7 million annually in energy costs. (Cassar-FRC)
W83-02771

EFFECTIVE START-UP TRAINING FOR WASTEWATER TREATMENT PLANTS,

Onondaga County Dept. of Drainage and Sanitation, Syracuse, NY.
R. R. Metcalf.
Public Works, Vol 113, No 12, p 49-50, December, 1982. 1 Tab.

Descriptors: *Training, *Personnel, *Process control, *Wastewater treatment, Plants, Operating policies, Maintenance, Scheduling.

For effective training during wastewater plant startup, the owner must start planning before the contract stage. All aspects of training desired from manufacturer's representatives must be specified. Adequate time must be allotted for each phase of instruction. Training time must be separate from the final adjustment period. Equipment suppliers should include the following training: proper installation of equipment, routine and emergency startup and shutdown procedures, routine operation and maintenance, and basic troubleshooting. Instruction in basic treatment processes should be provided for new personnel and reviewed for experienced personnel before the manufacturer's training programs. A sample schedule is given in a table. It is designed to provide an orderly sequence and a minimum of overlap in subjects. The most critical processes were scheduled early in the 10-month program. (Cassar-FRC)
W83-02772

DYNAMICS OF PHOSPHORUS AND NITRATE REMOVAL FROM PARTIALLY PURIFIED WASTE WATERS OF PIG BREEDING FARMS BY MEANS OF ISOLATE CULTIVATIONS FROM THE GENERA CHLORELLA AND SCENEDESMUS (DINAMIKA NA OTSTRANYAVANE NA FOSFOR I NITRATI OT CHASTICHNO BIOLOGICHNO PRECHISTENA OTPADUCHNA VODA OT SVINEKOMPLEKS PRI KULTIVIRANE NA IZOLATI OT RODOVETE CHLORELLA I SCENEDESMUS),

Bulgarian Academy of Sciences, Sofia. Nauchno-Proizvodstvena Lab. po Algologiya.
K. M. Benderliev, H. V. Dilov, and N. V. Cherkezov.
Khidrobiologia (Sofia), Vol 13, p 39-45, February, 1981. 5 Tab, 14 Ref. (No English summary.).

Descriptors: *Animal wastes, *Phosphorus, *Nitrate, Algae, *Wastewater treatment, *Chlorella, *Scenedesmus, Biological treatment, Productivity, Phosphates, Nitrates.

The productivity of eleven isolates from the genera Chlorella and Scenedesmus acutus and three mixed samples of Chlorella sp and Scenedesmus sp was studied in partially purified waste water from pig farms. The study measured the

daily removal rates of total phosphorus, inorganic phosphates and nitrates. The highest percentage of removal for all isolates occurred during the first 24 hours of cultivation. The fresh cultures accumulate 2 to 7 times more phosphorus than those in steady state. Under conditions where the pH is between 7.1 and 7.3 during the first 24 hours, not more than 40% of the phosphorus and up to 90% of the nitrate are removed from the waste waters. The best results were obtained with 1/1 mixtures of Chlorella sp and Scenedesmus sp. For control of phosphorus in this type of wastewater, chemical treatment is recommended. It is suggested that if an algalbacterial suspension were supplied instead of potable water, no nitrate toxicity problem could arise. (Baker-FRC)
W83-02773

5E. Ultimate Disposal Of Wastes

EFFLUENT LIMITATIONS BASED ON WATER QUALITY,
Delaware State Dept. of Natural Resources and Environmental Control, Dover. Water Resources Section.
R. J. Touhey, and G. L. Esposito.
Public Works, Vol 113, No 11, p 43-46, November, 1982. 1 Fig, 1 Tab.

Descriptors: *Pollution load, *Effluent limitations, *Water quality control, Wastewater treatment, Lewes, Rehobeth Beach, *Delaware, Model studies, Coliforms, Nutrients, Nonpoint pollution sources, Wastewater disposal, Disinfection, Dissolved oxygen, Oxygen.

Water quality in the Lewes-Rehobeth Canal (Delaware) has limited waste assimilative capacity because of significant nonpoint source loads and limited flushing. Nevertheless, it was chosen as a viable alternative for disposal of effluent from proposed upgraded wastewater treatment plants which will include secondary treatment, filtration, and disinfection. A water quality model for the canal was developed, calibrated, verified, and used to evaluate 10 different discharge scenarios from zero discharge to concentrations similar to discharge of the present primary treated wastewater. Although nitrogen was found to be the limiting nutrient in Rehobeth Bay, there is no need for permit limits at the present time. Coliform levels are a major concern, but little regrowth occurs at the proposed high degrees of treatment and disinfection. Chlorine residuals must be carefully monitored and regulated. Upgrading the treatment to the secondary level will improve dissolved oxygen levels only modestly. A waste load allocation approach will ensure that water quality will not deteriorate below 1973-79 levels. (Cassar-FRC)
W83-02466

THE SEA EFFLUENT PIPELINE - ENVIRONMENTAL BLUNDER OR SOCIO-ECONOMIC BOON.
Civil Engineer in South Africa, Vol 24, No 5, p 188-189, 1982.

Descriptors: *Outfall, *Outfall sewers, *Wastewater outfall, *Industrial wastewater, *Pipelines, Industrial wastes, Conveyance structures, Environmental effects, Water pollution effects, Pulp and paper industry, Fertilizers, Bays, Richards Bay, *South Africa.

The controversy between planners and environmentalists over the Richards Bay proposed sea outfall scheme is discussed. The proposed pipeline will collect industrial and municipal effluents in Richards Bay and discharge them between three and four kilometers out to sea. The pipeline may be necessary in order for industrial development to continue, but it may have a devastating effect on the environment. Initial effluent contributors will be a paper company, a fertilizer company, and the town. Ultimately, 176,100 cu m/day will be discharged (in 2013). All effluents will be subject to conditions determined by the Department of Environmental Affairs in consultation with the South African Bureau of Standards, the Sea Fisheries Institute, and the Department of Health. The strongest justification for the pipeline is socio-economic, as the need to create jobs for KwaZulu's citizens is an important national priority. Environmental studies are planned to assess the effects of the outfall. (Small-FRC)
W83-02517

SLUDGE DISPOSAL IN SOUTHERN CALIFORNIA BASINS,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
G. A. Jackson.
Environmental Science and Technology, Vol 16, No 11, p 746-757, November, 1982. 7 Fig, 11 Tab, 37 Ref.

Descriptors: *Sludge disposal, *Ocean dumping, *Environmental effects, Marine environment, Organic matter, Model studies, Santa Monica, San Pedro, *California, Sulfides, Nitrates, Trace metals, Metals, Sedimentation, Dissolved oxygen, Oxygen, Particulate matter, Disposal.

A one-dimensional model of physical and chemical processes in the San Pedro-Santa Monica Basin, California, was developed to predict environmental responses to different ocean disposal strategies for digested sewage sludge. Disposal at 600 m or deeper would seriously reduce oxygen concentrations to as low as 1.3 micro M. However, sludge disposal at 400 m would decrease dissolved oxygen levels only slightly. Heavy metals inputs were estimated at 3-9 times present levels. Organic loads would increase by 3.5 times to 9.2 billion mol of 02(BOD) per year. Nitrate reduction in the basin would increase by 56% over present levels. Sulfide buildup is not expected to be significant. The increased amount of particulate carbon and dissolved organic carbon in the basin could change species composition of the faunal communities. (Cassar-FRC)
W83-02527

PRIORITY POLLUTANTS IN MUNICIPAL SEWAGE SLUDGE,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
L. M. Naylor, and R. C. Loehr.
BioCycle, Vol 23, No 4, p 18-22, July/August, 1982. 9 Tab.

Descriptors: *Sludge disposal, *Land application, *Risks, Priority pollutants, Fate of pollutants, Pesticides, Organic compounds, Metals, Chlorinated hydrocarbons, Phenols, Hydrocarbons, Aromatic compounds, Toxicity, Ammonia, Nitrogen compounds, New York.

Concentrations of 24 organic and 7 metallic priority pollutants in undigested combined municipal sludges are listed. Projected land application rates for each pollutant allow selection of an application rate which will avoid excess laoding of toxic materials. Median laodings ranged from 1.2 kg per ha dry weight for bis-2-ethylhexyl phthalate to 0.0027 kg per ha dry weight for benzene. Metals applied at a median loading remain in the soil from 18 to 135 years. Calculated sludge application rates for the 13 sludges investigated were 5-13 (median, 11) tons per acre on a dry solids basis. Cadmium was limiting in only one sludge, copper and zinc were limiting in New York sludges. (Cassar-FRC)
W83-02552

AEROBIC THERMOPHILIC DIGESTION OF SEWAGE SLUDGE,
Welsh Water Authority, Powys (Wales). Directorate of Scientific Services.
H. G. Gunson, and S. F. Morgan.
Effluent and Water Treatment Journal, Vol 22, No 8, p 319-320, August, 1982.

Descriptors: *Sludge digestion, *Wastewater treatment, *Aerobic thermophilic digestion, Sludge disposal, Sludge treatment, Aerobic digestion, Sewage sludge.

A body of experience has been gained handling domestic, agricultural and industrial sludges which confirms that aerobic digestion of sludges at elevated temperatures using air as the oxidant gas can be a viable technique provided that an efficient aeration and mixing system is employed and that due attention is paid to the quality of the sludge and the design of the reactor. The process offers considerable capital cost savings, gives immediate relief from odor, provides an attractive aerobic treated sludge and indicates a route to the longer term goal of pathogen reduction. Failures in earlier systems have been attrributed to use of a weak, intractable sludge or one with an imbalance such that a sufficient flux of heat was not generated; use of a digestor or reaction vessel of shape, size, or in a location such as to mitigate against heat conservation; or the use of an aerator with a low efficiency of oxygen transfer such that the high volume of inactive gases being passed through the digester contents acted as a cooling influence. (Baker-FRC)
W83-02568

BIOMASS OF MARINE MACROFAUNA COMMUNITIES IN A DUMPING AREA OF SEWAGE SLUDGE NEAR THE ELBE ESTUARY (DIE BIOMASSE MARINER MAKROBENTHOS-GESELLSCHAFTEN IM BEMUNDUNG),
Zoologisches Inst. und Museum, Hamburg (Germany, F.R.).
For primary bibliographic entry see Field 5C.
W83-02627

A PUBLIC POLICY FOR HAZARDOUS WASTES,
Hofstra Univ., Hempstead, NY. School of Law.
For primary bibliographic entry see Field 6E.
W83-02653

THE ROLE OF BENTONITE IN SOIL SEALING APPLICATIONS,
International Minerals and Chemical Corp., Des Plaines, IL.
For primary bibliographic entry see Field 5G.
W83-02662

PROPERTIES OF NEW CHLORAMINE DISINFECTANT AND DETOXICANT,
Auburn Univ., AL. Dept. of Poultry Science.
E. C. Mora, H. H. Kohl, W. B. Wheatley, S. D. Worley, and J. H. Faison.
Journal of Poultry Science, Vol 61, 1982. p 1968-1971, 4 Tab, 16 Ref. OWRT OWP A-072-ALA(3), 14-34-0001-1101.

Descriptors: *Disinfection, Drinking water, Potable water, Treated water, Chemical analysis, Chemical treatment, *Chloramine, Assay, Toxicity, Chickens, Aflatoxin B1, Organic compounds, Alabama, *Wastewater treatment.

A new chloramine disinfectant, 3-chloro-4,4-dimethyl-2-oxazolidinone, was assayed for toxicity in chickens. The compound did not induce detectable toxic effects in chickens when administered in drinking water (200 ppm) for an 8-week period. The compound has a significant pH dependent ability to detoxify aflatoxin B sub 1.
W83-02733

TERRACED PASTURE FOR DISPOSAL OF DAIRY YARD RUNOFF,
Clemson Univ., SC. Dept. of Agricultural Engineering.
R. O. Hegg, C. L. Barth, V. L. Quisenberry, and W. H. Livingston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191940, Price codes: A04 in paper copy, A01 in microfiche. Report No 99, 1982, 42 p, 5 Fig, 6 Tables, 18 Ref. OWRT A-045-SC(1), 14-34-0001-0143.

Descriptors: Runoff, *Animal wastes, *Agricultural wastes, *Agricultural runoff, Rainfall-runoff relationships, Nitrogen, Phosphorus, Pastures, *South Carolina, Animal waste treatment, *Land application, Waste disposal.

An alternative system of handling and disposing of milking barn wastewater and feedlot runoff water

was evaluated for three years. This system was established on a 50-cow dairy farm in south Carolina and consisted of utilizing a pasture areas downslope from a dairy to infiltrate and filter the liquid, nutrients and solids from the milking barn and the diary feedlot runoff water. The pasture was modified by the addition of a spreader terrace and three level terraces to distribute the runoff water. Wastewater discharged from the milking barn typically infiltrated the soil before reaching the terrace system. Several of the small rainstorms produced runoff from the dairy feedlot which was completely infiltrated by the terraced pasture. The concentration of the runoff water leaving the dairy feedlot was reduced by the time it left the terraced pasture, for rains which produced runoff at both weirs, by an average percentage of: NH sub 3 -N, 87; TKN, 88; PO sub 4 -P, 79; COD, 83; TS, 50; total coliform, 79; and fecal coliform, 90. The mass of nutrients was reduced by an average of: NO sub 3 - N, 75; NH sub 3 -N, 69; TKN, 76; PO sub 4; 68; COD, 91 and TS, 14 all as percentages, including rains that produced runoff from the feedlot but not necessarily from the terraced pasture. The system performed very satisfactorily. The operator did not have to spend any time or money on the disposal system after the initial preparation of the terraced pasture.
W83-02741

FATE OF HEAVY METALS AND POTENTIAL FOR CLINKER FORMATION DURING PILOT SCALE INCINERATION OF MUNICIPAL SLUDGE,
Canada Centre for Inland Waters, Burlington (Ontario).
H. W. Campbell, P. J. Crescuolo, and T. R. Bridle.
Water Science and Technology, vol 14, No 6/7, p 463-473, 1982. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Incineration, *Heavy metals, *Sludge, Sludge disposal, Municipal wastewater, Wastewater treatment, Mercury, Lead, Arsenic, Cadmium, Silica, Chromium, Copper, Aluminum, Nickel, Iron, Zinc, Phosphorus, Ontario.

Pilot scale investigations were conducted at the Hamilton, Ontario Water Pollution Control Plant (WPCP) by the Wastewater Technology Centre during the period from July 1976 to May 1977 using a six-hearth natural gas fired sewage sludge incinerator. The study was made to determine under controlled conditions the fate of a selected number of elements within the normal ranges of operating parameters or a multiple-hearth incinerator handling municipal sewage sludge and to determine the optimal and/or boundary conditions of temperature, throughput capacity and center shaft speed with regard to the prevention of clinker formation while minimizing the residual organic content of the incinerator ash. Phosphorus, zinc, iron, magnesium, aluminum, nickel, copper, calcium, chromium, lead and silica remained in the ash. The degree of cadmium volatilization was a function of the temperature, ranging from a loss of cadmium in the ash of 25% at 760C to 56% at 928C. Arsenic was classified to the gas stream but not discharged to the atmosphere. More than 99% of the mercury was classified to the gas stream under all operating conditions. It was concluded that Hamilton WPCP sludge could be incinerated in the pilot study unit without clinker formation at temperatures up to 928C provided the residence time was minimized. The destruction of total carbon was essentially complete over the entire range of operating conditions studied. The minimum level of destruction achieved was 98.7%. (Baker-FRC)
W83-02789

APPLICATION OF THE MARAIS - EKAMA ACTIVATED SLUDGE MODEL TO LARGE PLANTS,
Johannesburg City Health Dept. Lab. (South Africa).
H. A. Nicholls.
Water Science and Technology, Vol 14, No 6/7, p 581-598, 1982. 8 Fig, 7 Tab, 6 Ref.

Descriptors: *Model studies, *Wastewater treatment, *Activated sludge process, Marais-Ekama model, Nutrients, Oxygen consumption, Sludge thickening, Sludge conditioning.

The Marais-Ekama model describes the behavior of most activated sludge systems by predicting the effluent quality, oxygen consumption and sludge concentration produced. This model was used to successfully predict the performance of two 50,000 cubic meter/d five-stage nutrient removing activated sludge plants. The experimental data used to test the model was obtained by monitoring the feed, effluent and contents of each reactor in the process, every two hours for 4 days. In addition, a respirometer was developed to measure the oxygen utilization rate automatically every 30 minutes. All data collected was found to be valid, as acceptable COD and nitrogen balances across the plants were possible. The data was then compared with the steady state and unsteady state responses of the model. It was found that the model could successfully predict the COD, TKN, ammonia and nitrate concentrations in the effluent and illustrate some shortcomings in the process layouts. This indicated that the model could be used by designers and operators of large scale plants to predict performance and highlight problem areas. (Baker-FRC)
W83-02791

5F. Water Treatment and Quality Alteration

DESIGN OF THE LOS ANGELES AQUEDUCT WATER FILTRATION PLANT,
Los Angeles City Dept. of Water and Power, CA.
D. G. McBride, P. W. Prendiville, and M. G. Hoover.
Public Works, Vol 113, No 11, p 36-38, November, 1982. 2 Fig.

Descriptors: *Filtration, *Ozonation, *Flexibility, *Los Angeles, *California, *Water treatment, Coagulation, Flocculation, *Design, Treatment facilities.

A 900 cfs water filtration plant is being designed to reduce turbidity in the Los Angeles Aqueduct water to 0.3 units and meet other water quality goals of disinfection and < 100 ppb trihalomethanes. This joint effort of the Los Angeles Department of Water and Power and the Metropolitan Water District of Southern California will feature ozonation in a flexible process train, which also includes coagulation in variable speed rapid mixers, flocculation, and filtration through single media. Pilot tests showed cationic polymer and ferric chloride to be most effective. Provisions for other chemicals (bentonite, alum, ammonia, caustic soda, and chlorine) increase the ability of the system to react quickly to changes in raw water quality. The plant will be built in 2 mirror-image modules. Sedimentation basins can be added later if necessary. Water can bypass sections of the treatment process if desired. An overflow structure will divert water to the Los Angeles reservoir when plant throughput exceeds demand. The plant is scheduled to begin operation in August 1985. (Cassar-FRC)
W83-02468

SORPTION INCINERATION OF CHLORINATED HYDROCARBONS, ACID, HEAVY METALS, AND EXCESS NUTRIENTS IN WATER USING COAL-DERIVED SOLIDS,
Missouri Univ.-Columbia. Dept. of Chemistry.
S. E. Manahan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190652, Price codes: A02 in paper copy, A01 in microfiche. Missouri Water Resources Research Center Completion Report, Univ. of Missouri, Columbia, December 1982. 6 p, 1 Fig, OWRT B-150-MO(1), 14-34-0001-1279.

Descriptors: Water pollutants, *Activated char, *Organic pollutants, *Heavy metal, Water purification, *Incineration, *Sorption, Acids, Nutrients, *Coal, *Coal gasification, Coal pyrolysis.

Activated char produced by the gasification or pyrolysis of sub-bituminous coal was found to be effective in removing a number of important pollutants from water. Among these were organic byproducts produced from coal gasification and heavy metals. The organic byproducts of coal gasification served as model organic water pollutant compounds, and included hydrocarbons, phenols, and nitrogen compounds. Heavy metals were also effectively removed by the activated coal char. The char found most effective for heavy metal removal was that produced from 're-burning' char twice in a reverse-burn gasification mode. Subbituminous coal ash was likewise found effective in removing organic compounds and heavy metals from water.
W83-02484

OZONALYSIS FOR WATER REUSE APPLICATIONS,
Vanderbilt Univ., Nashville, TN. Dept. of Chemical Engineering.
J. A. Roth, and K. A. Debelak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186510, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Research Report No 82, Univ. of Tennessee, Knoxville, December 1982. 39 p, 12 Fig, 3 Tabs, 24 Ref. OWRT A-058-Tenn(3), 14-34-0001-0145.

Descriptors: *Ozone, *Water reuse, *Wastewater treatment, *Temperature, Decomposition, Solubility, Pollutants, Oxidation, *Hydrogen ion concentration.

Both the rate constants for ozone self-decomposition in aqueous solution and Henry's law constants were determined as a function of pH and temperature. A completely mixed, isothermal, semi-batch reactor system was used. The experimental conditions covered a pH range of 0.45 to 10.2 and a temperature range of 3.5C to 60C. The rate at which dissolved ozone undergoes self-decomposition is a function of pH and temperature of the aqueous solution. First order kinetics represent the self-decomposition of ozone satisfactorily. The relationship between the specific rate constant, hydroxide concentration, and temperature is determined over the range of variables investigated using multilinear regression. The ozone equilibrium concentration cannot be achieved when the rate of decomposition is significant relative to the rate of mass transfer of the ozone into the liquid. The solubility is calculated from experimental measurement of ozone uptake rate, ozone decomposition rate, and the steady ozone concentration. The ozone solubility in water varies with pH and temperature. The Henry's law constant was correlated with the temperature and hydrozide concentration using multilinear regression. These values are recommended for use rather than those of previous investigation who incorrectly assumed the experimentally determined steady state concentration was the equilibrium concentration.
W83-02498

A SMALL FACILITY FOR THE OZONE TREATMENT OF WATER (KLEINANLAGE ZUR OZONBEHANDLUNG VON WASSER),
Wasser, Luft and Betrieb, Vol 26, No 4, p 20, 1982. 1 Fig, 2 Tab. (No English Summary).

Descriptors: *Water treatment, *Ozonation, *Water treatment facilities, *Disinfection, *Drinking water, Ozonic 145, Mobile ozonation device, Wastewater treatment, Small water treatment facilities.

The treatment of small amounts of water with ozone has not usually been viable, due to high costs or technical problems. The Ozonic 145, a mobile or stationary device, allows ozone treatment of 2,000 l/hr of drinking water. A compressor connected to the ozone device draws in air from the atmosphere which is then dried by a 'heatless' mini-dryer to a dew point of -60C (prerequisite for optimal ozone production). The dried air is partially transformed into ozone as it passes through the ozone pipe, using the silent discharge principle. This occurs with the aid of patented electronic control procedure. An injector introduces the ozone into the water to be treated. Small

bubbles of ozone are most effective, as they provide optimal binding conditions due to their large surface area. A monitoring system ensures that no harmful ozone residue remains in the water. Small treatment facilities can produce 2, 4, 6, 8 or 12 g ozone/hr with a maximum concentration of 8 g/N cu m. The device is also suitable for larger facilities. As a mobile device, the Ozonic 145 is mounted on a flat-bed trailer and driven by a 3.7-kilowatt motor. A study was conducted to test the device using 500 l of water from an overloaded wastewater treatment facility to which T4 phages had been added. Ozone was mixed with the circulating water by means of an injector system in quantities of 1.4 g/hr at a concentration of 7 g/N cu m. Some degradable substances were completely degraded by the system, and disinfection was almost complete. Water quality was directly dependent upon redox potential; only when this reaches approximately + 600 millivolts is the water suitable for drinking. (Gish-FRC)
W83-02509

FORMATION AND REMOVAL OF MUTAGENIC ACTIVITY IN DRINKING WATER BY OZONISATION,
Antwerpse Waterwerken (Belgium).
F. Van Hoof.
Aqua, No 5, p 475-478, 1982. 6 Fig, 2 Tab, 9 Ref.

Descriptors: *Ozonation, *Chlorination, *Mutagens, *Water treatment, Drinking water, Organic matter, Meuse River, Fate of pollutants, Water pollution effects, *Belgium.

The effect of different ozone doses on mutagenic activity of chlorinated drinking water was studied using surface water derived from the River Meuse. The treatment process included breakpoint chlorination, alum and activated silica coagulation, dual layer filtration, and partial dechlorination with sodium bisulfite. Ozone doses were 1.9 + or - 0.2, 3.8 + or - 0.5, and 7.6 + or - 0.9 mg per liter. Neutral and acid (pH, 2) water samples were concentrated in ion exchange columns. All influents (neutral fraction) showed mutagenic activity on strains TA 98 (maximum levels of 40 revertants per liter) and TA 100 (maximum levels of 200 revertants per liter) without enzyme activation. No activity was detected on strain TA 98 in any ozonated samples (neutral fraction) with or without enzyme addition. Activity in strain TA 100 decreased after application of the lowest ozone dose. Increasing ozone doses further decreased activity on strain TA 100. Mutagenic activity was well correlated with levels of organic substances as expressed by ultraviolet absorbance. The acid fractions (hydrophilic compounds) of chlorinated and ozonated waters produced no mutagenic activity on TA 98, indicationg the absence of frameshift mutagens. However, ozonation markedly increased mutagenic activity of the acid fraction on strain TA 100. These mutagens were direct acting. Although ozonation removed direct acting mutagens from the neutral fraction, it increased formation of direct acting mutagens in the acid fraction. Therefore, ozone cannot be considered a good alternative to chlorine with respect to mutagenic activity in water. (Cassar-FRC)
W83-02510

THE DEGREE OF UTILIZATION OF ANION EXCHANGE FILTERS IN NITRATE REMOVAL FROM DRINKING WATER (AUSNUTZUNGSGRAD VON ANIONENAUSTAUSCHFILTERN BEI DER NITRATENTFERNUNG AUS TRINKWASSERN),
Ingenieurhochschule Zittau (German D.R.). Sektion Kraftwerksanlagenbau und Energieumwandlung.
J. Bosholm.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 1, p 83-87, 1980. 1 Fig, 6 Ref. (No English Summary).

Descriptors: *Anion exchange, *Filters, *Nitrates, *Nitrogen removal, *Drinking water, *Water treatment, Ions, Chlorides, Sulfates, Mathematical analysis, Graphical analysis.

The author's previously published method for the calculation of ion exchange processes is used to estimate the influence of various concentrations of chloride and sulfate ions on the efficiency of highly basic anion exchangers in the chloride form used to remove nitrates in the treatment of drinking water. The degree of utilization of such a filter is illustrated in a diagram for contents of 0.500 mg/l chloride and sulfate ions and for a nitrate ion concentration of 60 mg/l. The diagram permits easy calculation of the degree of utilization and run time for ion exchange filters for various compositions of water. From the degree-of-utilization value given by the diagram, the usable volume capacity (assuming a breakthrough concentration of the nitrate ions of 0.3-0.5) can be calculated; from this, the volume of water that can be treated up to this breakthrough point can be found. Similar predictions for other breakthrough concentrations can be made if the breakthrough curve is calculated; this is possible if concrete operating data for the ion exchange filter are known. Agreement between values calculated by means of the diagram and previously published experimental values was good. (Gish-FRC)
W83-02512

EFFECT OF RECOVERY ON DESALINATION OF THE BLACK SEA WATER BY REVERSE OSMOSIS,
Higher Inst. of Chemical Technology, Burgas (Bulgaria). Dept. of Water Technology.
For primary bibliographic entry see Field 3A.
W83-02522

SHIP-MOUNTED SEAWATER 2500 CU M/D FLASH EVAPORATION PLANT FOR ADU DHABI ECONOMICAL DRINKING WATER FOR ARID REGIONS,
Buckau-Walther A.G., Essen (Germany, F.R.). Water Engineering Div.
For primary bibliographic entry see Field 3A.
W83-02524

HIGH PURITY WATER USING H202 AND UV RADIATION,
Interox Chemicals Ltd., Widnes (England).
N. Clarke, and G. Knowles.
Effluent and Water Treatment Journal, Vol 22, No 9, p 335-338, 340-341, September, 1982. 2 Fig, 4 Tab, 14 Ref.

Descriptors: *Water treatment, Water quality, *Feedwater treatment, Boilers, *Hydrogen peroxide, Oxidation, Chlorination, Chlorides, Demineralization, Industrial water, Radiation, *Ultraviolet radiation.

Organic contamination in raw water supplies can cause severe problems in a variety of industrial processes, particularly in the treatment of water for boiler feed in steamraising equipment. The article discusses the development of a method for the oxidation of dissolved organics in water using photoactivated hydrogen peroxide. UV/H202 treatment as an additional stage in the preparation of demineralized water for boiler feedwater makeup is shown to improve water quality by converting organic matter to carbon dioxide or to lower molecular weight organic compounds, possibly with active groups with less tendency to foul the anion resins, and degrading the organic chlorides present in the water to ionic chloride, which could then be removed on the anion resins and, as a consequence, not pass forward to the boiler feed water. As a result of this treatment it should be possible to keep the anion resin beds in good condition for longer periods. The lower levels of organic chloride going to the boilers will maintain the chlorides in boiler water within required limits with very much reduced blowdown levels. The net result will be substantial savings in water and heat losses. (Baker-FRC)
W83-02531

WATER CHEMICALS CODEX,
National Research Council, Washington, DC.
R. Rehwoldt.
Environmental Science and Technology, Vol 16, No 11, p 616a-618A, November, 1982. 2 Tab.

Descriptors: *Chemicals, *Water treatment codex, *Standards, National Academy of Sciences, National Research Council, Water treatment, Coagulation, Flocculation, Chemical precipitation, Disinfection, Water softening, Chemical analysis.

The National Research Council's Committee on Water Treatment Chemicals developed a Water Treatment Chemicals Codex. It consists of a series of monographs, each on a specific water treatment chemical. Monographs include chemical and physical properties, function, use range, purity requirements, bulk sampling procedures, and analytical procedures. The formulas for calculating the Recommended Maximum Impurity Content for the additives is given. The following compounds are included in the Codex: aluminum sulfate, ammonia, ammonium hydroxide, ammonium sulfate, calcium hydroxide, calcium hypochlorite, calcium oxide, activated carbon, carbon dioxide, chlorine, ferric chloride, ferric sulfate, ferrous sulfate, fluosilicic acid, potassium permanganate, sulfur dioxide, and sodium salts (aluminate, carbonate, chlorite, fluoride, hydroxide, hypochlorite, metabisulfite, silicofluoride, and polyphosphate). (Cassar-FRC)
W83-02546

PESTICIDES IN GROUNDWATER: THE ALDICARB STORY IN SUFFOLK COUNTY, NY,
Suffolk County Dept. of Public Health, Hauppauge, NY.
M. H. Zaki, D. Moran, and D. Harris.
American Journal of Public Health, Vol 72, No 12, p 1391-1395, December, 1982. 4 Tab, 6 Ref.

Descriptors: *Groundwater pollution, *Drinking water, *Agricultural runoff, *Carbamate pesticides, *Water pollution sources, *Groundwater movement, Potable water, *Aldicarb, Pesticides, Insecticides, Public health, Wells, Water pollution effects, Monitoring, *New York, Suffolk County.

In August of 1979, traces of the carbamate pesticide aldicarb were detected in groundwater samples of Suffolk County, New York. Although the pesticide reached human drinking water supplies, no cases of carbamate poisoning were reported in area hospitals. An extensive monitoring program conducted by the County in cooperation with federal and state agencies and the Union Carbide Corporation showed that 13.5% of the 8,404 wells sampled exceedewd the state recommended limits for aldicarb of 7 parts per billion. Residents whose wells exceeded this limit were advised not to use the water for drinking or cooking and to obtain an alternate source of potable water. The Union Carbide Corporation provided these residents with activated carbon filtration units to remove most of the aldicarb and its metabolites. The aldicarb incident in Suffolk County raised many serious issues concerning the testing of pesticides under field conditions prior to registration and during their use, the validity of recommended action levels, and the long-term health effects resulting from the consumption of pesticides in trace concentrations. (Geiger-FRC)
W83-02560

DECOMPOSITION OF OZONE IN WATER: RATE OF INITIATION BY HYDROXIDE IONS AND HYDROGEN PEROXIDE,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
J. Staehelin, and J. Holgne.
Environmental Science and Technology, Vol 16, No 10, p 676-681, October, 1982. 8 Fig, 1 Tab, 31 Ref.

Descriptors: *Ozone, *Decomposition, *Drinking water, Potable waters, Wastewaters, Hydroxide ions, Oxidation, Ozonation, *Water treatment, Chemical reactions.

Studies were undertaken to separate, identify, and quantify the successive individual reactions that control the overall rate of ozone decomposition in drinking water and other aqueous solution. The results will allow better predictions of how the rates will be influenced by changes in water composition. The kinetics by which the decompostion of ozone in water is initiated by water itself is described under conditions where secondary radi-

cal-type chain reactions are excluded by OH-radical scavengers. Such situations resemble those encountered when natural waters are ozonated. The findings suggest that reactions of OH- and HO2- with ozone can initiate radical chain reactions. The kinetic chain length of such reactions depends on the relative rate by which the radicals formed react with ozone compared with other solutes present in the solution. Therefore such chain reactions can be more important in pure water than in real drinking water or in some types of wastewaters where bicarbonate and organic impurities may significantly scavenge OH-radicals. (Baker-FRC)
W83-02577

ANODIC OXIDATION FOR DRINKING WATER DISINFECTION, PART 1: BACTERIOLOGIC STUDIES IN PRACTICAL USE (ANODISCHE OXYDATION TRINKWASSERDESINFEKTION, 1. MITTEILUG: BAKTERIOLOGISCHE UNTERSUCHUNGEN BEI PRAXISEINSATZ),
Mainz Univ. (Germany, F.R.). Hygiene Inst.
M. Borneff.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 4, p 141-146, April, 1981. 2 Fig, 5 Tab, 10 Ref.

Descriptors: *Bacteria, *Anodic oxidation, *Water purification, *Drinking water, Water quality, *Water treatment, Oxidation, Chlorination, Haloforms, Microbiological studies, *Federal Republic of Germany.

The bactericidal effect of anodic oxidation for water purification was tested in an electrolytic polarization unit developed by Reis et al. The results attained in laboratory experiments (reduction of E. coli approximately log 7) agreed with those of other authors under practical conditions; however, the inactivation was less effective (reduction of waterborne bacteria about 1-3 log). In comparison to other means of water disinfection the anodic oxidation system still needs to be improved technically and econimically before being put into practical action. Its decontaminating effect is caused mainly by production of free chlorine, thus implying the formation of haloforms. (Author's abstract)
W83-02588

ANODIC OXIDATION FOR DRINKING WATER DISINFECTION, PART II: STUDIES ON HALOFORM FORMATION (ANODISCHE OXIDATION ZUR TRINKWASSERDESINFEKTION, II. MITTEILUNG: UNTERSUCHUNGEN ZUR HALOFORMBILDUNG),
Mainz Univ. (Germany, F.R.). Hygiene Inst.
E. H. Pfeiffer.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 5, p 185-189, May, 1981. 7 Fig, 3 Tab, 6 Ref.

Descriptors: *Drinking water, *Disinfection, *Haloforms, *Oxidation, Anodic oxidation, *Water treatment, Trihalomethanes, Chloroform, Bromoform, Chlorine, Chlorination, Hypochlorite, Chemical reactions, *Federal Republic of Germany.

The formation of haloforms was analyzed during oxidation treatment of different water samples under field and laboratory conditions. Employing a current of 3 to 9 A in field experiments the total of the trihalomethanes (chloroform, dichlorobromomethane, dibromochloromethane, and bromoform) in the water increased from 0.15 to 26.1 micrograms/liter, surpassing the level of 25 micrograms/liter recommended by the drinking water commission of the BGA. Up to 5 A haloform concentrations were similar to those resulting from treatment by chlorination; however, with 5 A bacterial inactivation was not sufficient. Laboratory experiments with a smaller reactor cell made it possible to analyze the impact of water quality on haloform formation. An additional increase in haloform concentration was noted when 5 mg/l humic acid was added to the water. In tap water with high initial haloform concentrations of 34.7 micrograms/liter, treatment with high current intensities increased this concentration to 101.7 micrograms/liter. The free chlorine increased exponentially with increasing current intensity, reaching values above 7 micrograms/liter. These findings suggest that the effect of A0 on waters containing electrolytes is based mainly on the formation of hypochlorite. (Baker-FRC)
W83-02589

THE DEVELOPMENT OF THE PUBLIC DRINKING WATER SUPPLY IN THE FEDERAL REPUBLIC OF GERMANY IN THE FIRST QUARTER OF 1982 (DIE ENTWICKLUNG DER OFFENTLICHEN TRINKWASSERVERSORGUNG IN DER EUNDESREPUBLIK DEUTSCHLAND IM I. QUARTAL 1982),
Bundesgesellschaft fuer Wirtschaft (Germany, F.R.).
D. Perdelwitz.
Gas- und Wasserfach: Wasser/Abwasser, Vol 123, No 7, p 365-368, July, 1982. 8 Tab. (No English Summary).

Descriptors: *Water supply, *Drinking water, *Water delivery, *Water demand, *Statistics, Surveys, *Federal Republic of Germany, Precipitation, Air temperature, Weather.

Statistics collected by the BGW (German Economics Group) in a random sampling of III West German water supplying concerns (WSC) for the first quarter of 1982 are discussed. The sample is considered representative of the entire West German public water supply system. Air temperature for the period (measured at six weather stations and averaged) was 1.6C, 1.0C higher than the first quarter of 1981 and 0.1C less than the long-range mean. Precipitation was 485 mm, 34% less than in 1981 (735 mm). Compared with the first quarter of 1981, water output rose by 0.2%, water supply rose by 0.2%, and water delivery to users rose by 0.8% (in contrast to the two preceding years, when it dropped slightly), while delivery to water suppliers dropped by 0.3% (due entirely to WSC with volumes of > or = 20 million cu m/yr delivering 0.4% less; the two smaller groups of WSC delivered 1.3 17.1% more water than in 1981). The sum of water use by the WSC themselves, losses, and reservoir surplus was 0.7% less in 1982 than in 1981 (in 1,000 cu m, 32,481 versus 34,929). Peak demand was almost the same in 1982 as it had been in 1981, the largest delivery in 1,000s of cu m in 1982 being 7,980, versus 8,152 in 1981 (average delivery, 6,929 in 1982, 6,885 in 1981). However, peak demand declined for the two smaller groups of WSC, while it remained constant for the largest group. In comparison with the first quarter of 1981, producer prices for water increased by 9.2%: by 9.5% for private households and by 8.8% for industrial users. Absolute prices increased more: by 10.3% for a household using 10 cu m/month, by 9.4% for industrial users of 1,000 cu m/month, and by 10.5% for industrial users of 10,000 cu m/month. (Gish-FRC)
W83-02607

CONVENTIONAL, UPFLOW, AND RADIAL FILTERS: COMPARISON AND MATHEMATICAL MODELLING,
S. Vigneswaran, and Y. A. P. Perera.
Effluent and Water Treatment Journal, Vol 22, No 10, p 377-381, October, 1982. 6 Fig, 3 Tab, 5 Ref.

Descriptors: *Filters, *Performance evaluation, *Head loss, *Water treatment, Upflow filters, Radial filters, *Rapid filters, Model studies.

Performances of upflow, radial, and conventional (single medium downflow) filters are compared. Head loss development is lower and more distributed over the filter depth in upflow filters than in conventional filters. Head loss profiles for comparable filter bed thicknesses show that head loss development in a radial filter is lower than that of a conventional filter and higher than that of an upflow filter. Bed volumes for upflow and radial filters are 1.2 times and 2 times greater, respectively, than those of conventional filters. Longest filter runs are produced by upflow filters, followed by radial filters. Mathematical modeling allows prediction of radial filter effluent concentrations using parameters calculated for the conventional filter. (Cassar-FRC)
W83-02615

EVALUATION OF THE RESULTS OF DRINKING WATER STUDIES ACCORDING TO APPENDIX 1 TO PARAGRAPH 3 OF THE DRINKING WATER ORDINANCE (AUSWERTUNG DER ERGEBNISSE VON TRINKWASSERUNTERSUCHUNGEN GEMASS ANLAGE 1 ZU PARAGRAPH 3 DER TRINKWASSERVERORDNUNG),
Baden-Wuerttemberg Landesanstalt fuer Umweltschutz (Germany, F.R.). Inst. of Seenforschungs Fischereiwesen.
R. Feierabend, H. Hagenmaier, and G. Wagner.
Gas- und Wasserfach: Wasser/Abwasser, Vol 122, No 10, p 446-451, October, 1981. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Drinking water, *Pollutant identification, Water quality, Water supplies, Sulfates, Nitrates, Fertilizers, *Federal Republic of Germany, *Water quality standards.

The Order Concerning Drinking Water in Germany came into force in 1976. Twelve constituents injurious to health were to be determined in drinking water samples. According to results based on 700 samples, dividing the quality of the water sampled into six categories according to degree of contamination, most concentrations fell below 10% of the limiting value as well as below the sum of the limit of detection plus allowable error of measurement. Moderate values were frequently found in the cases of nitrate from fertilizers and sulfate from geological formations. (Baker-FRC)
W83-02618

COMPARISON OF THE DRY SUBSTANCE OF SESTON AND THE POTASSIUM PERMANGANATE CONSUMPTION IN THE RAW WATER FOR THE DRINKING WATER SUPPLY OF THE TOWN OF ROSTOCK (VERGLEICH DER SESTONTROCKENMASSE UND DES KALIUM PERMANGANATVERBRAUCHS IN ROHWASSER DER TRINKWASSERVERSORGUNG ROSTOCKS),
Rostock Univ. (German D.R.). Bereich Medizin.
L. Kalbe, K. Fender, and E. Grabitz.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 1, p 97-100, 1980. 3 Fig, 5 Ref. (No English Summary).

Descriptors: *Drinking water, Raw water, *Filtrate, *Potassium compounds, Comparison studies, Rostock, *German Democratic Republic, *Potasium permanganate, Projections, Correlation analysis, Mathematical studies, *Seston dry matter, Seston, Water treatment.

A comparison of filterable matter (seston dry mass, DM) and potassium permanganate (PP) consumption in raw water used for drinking water supplies in the city of Rostock (German Democratic Republic) was conducted for the years 1970-1977. The raw water was taken from the Warnow river. Mean monthly values for the eight-year period were 8.0 mg/l for DM and 40.7 mg/l for PP, with a correlation coefficient of 0.444. The correlation coefficient was significant at 5%, but was considered weak. For certain times of year (e.g., January-February, April-May-June, August-September, and October-November-December), mean monthly values of DM and PP showed a similar trend, but they diverged for February-March-April (DM declined while PP increased), June-July-August (DM decreased sharply then rose moderately, PP decreased gradually), and September-October (DM rose slightly, PP continued to decline). These differences were assumed to be due to changes in bioproduction, especially in spring (May), when biogenic suspended solids comprised the bulk of oxidizable oranic matter. Mean annual values displayed a basically similar trend for the study period. Data for PP was available for a longer period, and mean annual values were somewhat periodic: values increased continually during 1965-1970 and 1971-1975, and these increases were followed by brief decreases. This suggests that for long-term projections, values measured over periods of at least 10 yr should be used. From 1974 onwards, PP values were higher than ever before (> 41 mg/l); this could not be attributed to increased precipitation, since there was generally a drought from 1971 to 1976. (Gish-FRC)
W83-02641

HEMOGLOBIN-GLUTATHIONE RELATIONSHIPS IN TROUT ERYTHROCYTES TREATED WITH MONOCHLORAMINE,
Seattle Metro Water Quality Lab., WA.
For primary bibliographic entry see Field 5C.
W83-02660

TECHNICAL NOTE: REMOVING TRIHALOMETHANE FORMATION POTENTIAL BY COAGULATION WITH ACTIVATED SILICA AND CATIONIC POLYMER,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
B. Batchelor, and P. Yang.
Journal of the American Water Works Association, Vol 74, No 9, p 494-496, September, 1982. 4 Fig, 9 Ref.

Descriptors: *Water treatment, *Trihalomethanes, *Coagulation, Polymers, Activated silica, Silica, Drinking water, Potable water, Chemical reactions.

The results of jar test experiments are presented which demonstrate the limited ability of activated silica and a cationic polymer to remove trihalomethane formation potential (THMFP) when used as the sole coagulant or in conjunction with alum. A possible mechanism is derived to explain the results. All water samples were collected from the surface of Lake Somerville, near the water intake for Brenham, Texas. While the conclusions are limited by the experimental conditions studied and the water supply sampled, they suggest that the medium-molecular-weight cationic polymer used in the studies was not effective in removing THMFP when used alone or in conjunction with alum. A dose of activated silica (0.5 mg/L) substantially improved removal of THMFP when used alone or in conjunction with alum. When alum was the sole coagulant or when it was used in conjunction with activated silica or a cationic polymer, the pattern of THMFP removal could be explained in terms of the formation of positively charged colloids consisting of natural organic matter and aluminum hydroxides. The efficiency of activated silica in removing trihalomethane formation potential indicates that anionic organic polymers should also be evaluated for this purpose. (Baker-FRC)
W83-02681

MAINTAINING AGING SYSTEMS - BOSTON'S APPROACH,
Massachusetts Water and Sewer Commission, Boston.
J. P. Sullivan, Jr.
Journal of the American Water Works Association, Vol 74, No 11, p 555-559, November, 1982. 7 Tab, 8 Ref.

Descriptors: *Water distribution, *Maintenance, *Municipal water, Corrosion, Metering, Decision making, Planning, Lining, Water loss, Boston, Massachusetts.

A general description is offered of Boston's water supply. Current problems are reviewed with the capital plan and a discussion is given of programs designed for the rehabilitation and continuous maintenance of the water distribution system. By concentrating on three major areas: metering, leak detection, and a relaying and relining program, Boston is expected to reach its goal of having all mains more than 100 years old cleaned and relined or replaced by the year 2000. Currently the largest losses of water are attributed to meters that underregister water consumption. If, after remetering is performed, customers react as predicted to substantial increases in bills by repairing internal leaks, the overall effect will be a slight increase in metered sales against a more drastic drop in purchased water. Currently the city is in the sixth year of its 10 year leak detection program. The effects have been multiplying annually as more knowledge is gained about the system. By the end of 1981 about 70% of the system was surveyed with the remaining 30% left to go. While the city has a low frequency of main pipe failures, much of the pipe is heavily tuberculated or undersized for its present use. To achieve the goal of relining or replacing pipe more than 100 years old, about 18 km or pipe or 1% of the system must be rehabilitated or replaced annually. Priority scheduling for replacing or rehabilitating pipe is based on maintenance records, age records, loss of head tests and fire flow tests as well as proposed roadway construction by city and state agencies. (Baker-FRC)
W83-02689

SURVEY OF POLYELECTROLYTE COAGULANT USE IN THE UNITED STATES,
Syracuse Univ., NY. Dept. of Civil Engineering.
R. D. Letterman.
Journal of the American Water Works Association, Vol 74, No 11, p 600-608, November, 1982. 2 Fig, 26 Tab, 1 Ref.

Descriptors: *Coagulants, *Polyelectrolytes, *Standards, *Water treatment, Turbidity, Water quality, Surveys, Drinking water, Flocculation, Chemical analysis.

An analysis is presented of answers offered by more than 300 utilities to questions concerning their use of polyelectrolyte coagulants. The 'typical' plant uses polyelectrolyte coagulants in the treatment of water from a surface source and uses a conventional solid-liquid separation system. The raw water turbidity is higher than average in such cases. The plant adds a cationic polyelectrolyte solution in combination with alum to the raw water at the plant intake or the rapid mix unit. The dosage is on the order of 0.4 mg/liter. The plant uses about 46,000 pounds of polyelectrolyte per year for which it spends roughly $23,000. Although the polyelectrolyte may be purchased by private negotiations, it is equally likely that public bidding is used. Prospective suppliers are prequalified by a combination of laboratory jar tests and full-scale plant evaluations. The plant personnel feel that a polyelectrolyte standard is needed, and their greatest concerns are being able to measure the amount of active ingredient and the presence of unwanted contaminants in the solutions purchased. (Baker-FRC)
W83-02691

DESIGNING AND INSTALLING LARGE STEEL WATER MAINS TO PREVENT FAILURES,
Saint Louis City Water Div., MO.
S. T. Fletcher.
Journal of the American Water Works Association, Vol 74, No 11, p 568-575, November, 1982. 6 Ref.

Descriptors: *Pipelines, *Design criteria, *Installation, Maintenance, Inspections, Water conveyance, Water mains, Missouri, St. Louis.

Certain proven precautions can be taken in the design and installation of large-diameter steel conduits to prevent failures. Problems are illustrated by a description of a massive failure of an 1800 mm pipeline, the resulting investigation to determine the cause of the failure, and the legal settelement of damages. Factors seen to affect and promote brittle failure include the state of stress, temperature, impact load, weld defects, excessive cold work, stress concentrations, and thickness of plate. Controls to resist brittle fracture include composition, deoxidation practices and grain size. The pipe failure described occurred at the St. Louis Water Division on December 24, 1973. From the investigation of this failure it was determined that designers need to review each large diameter pipeline on an individual basis. Then a pipeline combines high hoop stresses, extreme temperatures, welded bell and spigot joints, and high value areas, a more closely controlled steel specification may be justified for portions of the pipeline. (Baker-FRC)
W83-02710

ORGANIZING AND ANALYZING LEAK AND BREAK DATA FOR MAKING MAIN REPLACEMENT DECISIONS,
D. K. O'Day.
Journal of the American Water Works Association, Vol 74, No 11, p 589-594, November, 1982. 6 Fig, 6 Tab, 12 Ref.

Descriptors: *Water mains, *Maintenance, Leakage, Water loss, Pipes, Water distribution, Decision making, Pipelines, Water conveyance.

Water main replacement decisions may be based on arbitrary criteria such as age or on historic operating records and the experiences of a utility. Use of the latter method enables a utility to analyze leak and break patterns and to develop rehabilitation-replacement plans. An overview is provided of the causes of water main breaks and leaks. Several studies are described in which main breaks have been analyzed in terms of pipe age, geographic location, and diameter. The cost of replacing a mile of water main is $200,000 to $500,000 in 1980 dollars. During this period of rising costs, shrinking revenues, and high interest rates, main rehabilitation-replacement decisions should be based on sound, reliable information. Replacement decisions should be based on the physical condition of mains, not on their age. A geographically oriented information system will cost $50 - $150 per mile to develop and $10 - $20 per year per mile to update with routine records. The monetary gain from improved main replacement decisions is several orders of magnitude greater than the cost of the information system. (Baker-FRC)
W83-02712

INSPECTING, PAINTING, AND MAINTAINING STEEL WATER TANKS,
Harper and Associates, Inc., Riverside, CA.
For primary bibliographic entry see Field 8G.
W83-02713

MAINTAINING DISTRIBUTION SYSTEM VALVES AND FIRE HYDRANTS,
Saint Louis County Water Co., University City, MO.
For primary bibliographic entry see Field 8C.
W83-02714

VOLATILE ORGANIC COMPOUNDS IN WATER AT THIRTY CANADIAN POTABLE WATER TREATMENT FACILITIES,
Health and Welfare Canada, Ottawa (Ontario). Health Protection Branch.
For primary bibliographic entry see Field 5A.
W83-02715

AERATION-DESTRATIFICATION OF LAKE EUREKA USING A LOW ENERGY DESTRATIFIER,
Illinois State Water Survey Div., Champaign.
V. Kothandaraman, and R. L. Evans.
ISWS Circular 155, 1982. 32 p, 17 Fig, 7 Tab, 18 Ref, 4 Append.

Descriptors: *Water quality, *Water treatment, *Destratification, *Lake restoration, *Aeration, Algae, Algal control, Oxygen demand, Chemical treatment, Raw water, Manganese, Chlorine, Iron compounds, Cost-benefit ratio, Costs, Odor control, *Illinois, Lake Eureka.

Lake Eureka had been a water supply source for about 40 years but, because of severe odor and taste problems, the city switched to a groundwater source; however, operational problems and higher costs ensued. The main purpose of the aeration-destratification was to determine if the lake's water quality could be improved by in-lake treatment so that it could be used again as a raw water supply source. From May through October 1981, a low-energy, mechanical, reversible draft destratifier was installed and used in combination with periodic applications of chelated copper sulfate followed by potassium permanganate. Physical, chemical and biological characteristics were monitored at the lake's deepest station. Using a 1 1/2 hp motor, the aerator was able to completely destratify the lake and maintain adequate oxygen levels throughout, even in deep bottom waters. Iron and manganese concentrations in the deep waters were reduced 97% from pre-aeration levels and chlorine demand values were reduced more than half. A prior study had correlated odor episodes in finished water with manganese and chlorine demand values. Treatment also caused a dramatic shift in

algal species, replacing problem causing blue-green algae with diatoms as the dominant species during summer months. Water quality was enhanced enough so that the lake can again be used as a raw water source. Operating the aerator-destratifier and chemical treatments will cost about $1,500. The cost savings in using lake water vs. groundwater will amount to $24,000 in power costs and $10,000 in chemical costs per year, and will benefit both the general public and direct water users. (Atkins-Omniplan)
W83-02720

CONTROL OF HALOFORM PRODUCTION DURING CHLORINATION OF NATURALLY OCCURING COMPOUNDS THROUGH PRE-OZONATION,
Northeastern Univ., Boston, MA. Dept. of Civil Engineering.
L. M. Hays, B. M. Baum, R. A. Isaac, and J. C. Morris.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191825, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 131, University of Massachusetts, Amherst, October 1982. 44 p, 16 Fig, 39 Ref, 1 Append. OWRT A-118-Mass(1), 14-34-0001-9023.

Descriptors: *Ozonation, *Chlorination, *Chlorinated Hydrocarbons, *Organic compounds, Carcinogens, Drinking Water, Potable Water, Alkaline water, *Trihalomethane, *Water treatment.

Trihalomethane (THM) can be produced upon chlorination of water containing naturally occuring organic compounds. Compounds investigated here were resorcinol, phloroglucinol, vanillin, syringaldehyde, tryptophan, indole, and alanine. The 8:1 molar ratio of HOCl to non-ozonated samples of organic compounds is less than the theoretical chlorine demand for all compounds but alanine. However, each experiment was monitored until only a very graduate increase in demand was being observed. Preozonation was effective at pH 7 in reducing haloform production in chlorinated samples of all of the compounds except alanine which exhibited an increased yield. Four of the seven compounds were also tested at pH 10. The results with alanine and syringaldehyde were consistent with those at pH 7 since more chloroform was produced with preozonation of the former while less resulted with preozonation of the latter. The remaining two compounds (vanillin and tryptophan) exhibited greater chloroform production after preozonation at pH 10 while the opposite occured at pH 7. There is no obvious explanation for this conflict, which should be verified in the case of vanillin, but it might be due to different oxidation mechanisms at pH 7 and pH 10. This possible effect also could impact the results with tryptophan.
W83-02727

ATTACKING ODORS WITH H202,
Camp, Dresser and McKee, Inc., Albuquerque, NM.
J. A. Burgh, and A. N. Gaume.
Water/Engineering and Management, Vol 129, No 11, p 26-28, 1982. 2 Fig, 2 Tab.

Descriptors: *Water quality, *Hydrogen peroxide, *Oxidation, Odors, Taste, Water supply, Drinking water, Potable water, Water treatment.

The application of hydrogen peroxide to control wastewater collection system odors is gaining in popularity. This powerful oxidizing agent is in itself relatively expensive, but the equipment needed for its storage and feeding is often not expensive. Use of H202 is particularly helpful for seasonal problems, in cases where installations must be made rapidly, where low capital cost is a primary consideration, where points of application are remote from treatment plants or other occupied facilities, and where effective control of odors is absolutely required. The performance of a typical system using H202 treatment is described. (Baker-FRC)
W83-02765

AQUATIC INVADERS,
Williamsport Sanitary Authority, PA. Wastewater Div.
M. H. Gerardi, and J. K. Grimm.
Water/Engineering and Management, Vol 129, No 11, 22-23, 1982. 1 Fig, 1 Tab, 4 Ref.

Descriptors: Water quality, *Aquatic animals, *Water distribution, Drinking water, Potable water, Shrimps, Fleas, Midges, Worms, Water quality control, Filtration, Filters, Pesticides, Pyrethroids, Water treatment.

Odor, taste and color problems in water supply systems are frequently the result of aquatic species found in water which had been treated and is ready for consumption. The most common animals thus found include the segmented worms, water fleas, freshwater shrimps, and midges. The appearance of aquatic animals within a water treatment plant or distribution system will coincide with the natural population cycles or breeding peaks for each species. Aquatic species may enter a distribution system through open reservoirs or through treatment plants which lack filtration units or which operate filtration units improperly. Since an infestation of aquatic animals is most likely to occur in spring or summer, water mains can be spot checked or surveyed for their presence during these seasons. If mains are infested, systematic flushing or pesticide dosing can be used to remove the animals. Pyrethrin, bioresmethrin, permethrin and resmethrin have been successfully used for this process. (Baker-FRC)
W83-02766

HALTING CREEK POLLUTION,
Rogue Valley Council of Governments, Central Point, OR.
For primary bibliographic entry see Field 5B.
W83-02768

KEEPING CLEAN WATER CLEAN,
East Bay Municipal Utility District, Oakland, CA.
K. B. Stinson.
Water/Engineering and Management, Vol 129, No 11, p 30, 32-33, October, 1982. 3 Fig, 4 Ref.

Descriptors: *Storage tanks, *Reservoirs, *Design criteria, *Water quality, Water quality control, Disinfection, Chlorine, Surface drainage, Construction, Materials, Corrosion, Water distribution, Water supply.

The quality of water can deteriorate for a variety of reasons on its way through a distribution system. Established practices that should be remembered and applied during the design, construction and operational stages of a typical water supply system are reviewed. Tanks and reservoirs should be made inaccessible to the public. They should be covered and protected from surface drainage. The water's exposure to sunlight should be minimized to prevent nuisance algal growths. All openings, including air vents, to the reservoir should be provided with insect-tight screens. Each access to the interior of the tank or reservoir should be equipped for inspection, cleaning and disinfection. The bottom of the tanks or reservoir should slope to a drain to facilitate washdown. Fire hydrants should be installed around the tank or reservoir to provide high-pressure water for hosing down the interior. Materials for use in tanks and reservoirs should be corrosion resistant. Spider rods should be eliminated from the inside of the tanks where feasible. A tap on the tank or reservoir inlet-outlet line to facilitate the injection of chlorine solutions for disinfection is useful. (Baker-FRC)
W83-02780

VALVE AND HYDRANT MAINTENANCE,
Waukesha City Water Utility, WI.
J. H. Kuranz, and B. S. Barrett.
Water/Engineering and Management, Vol 129, No 11, p 33-34, 37-38, November, 1982. 3 Fig, 1 Ref.

Descriptors: *Maintenance, *Valves, *Hydrants, Water distribution, Water supply, Cost-benefit analysis, Water quality control.

All water utilities should have an established, progressive valve and hydrant maintenance program. It should involve periodic valve exercising, hydrant inspections, painting, and other routine servicing and recording operations. A review of valve and hydrant maintenance programs indicates several practices and procedures which are among those most commonly used by water utilities. The most vital aspect of the maintenance program is the checking of opening and closing functions, drainage, and the condition of the threads on the nozzles. (Baker-FRC)
W83-02782

SLOW SAND FILTRATION FOR CERCARIAL CONTROL IN NORTH CAMEROON VILLAGE WATER SUPPLY,
Johns Hopkins Univ., Baltimore, MD. Dept. of Environmental Health Engineering.
K. Kawata.
Water Science and Technology, Vol 14, No 6/7, p 491-498, 1982. 3 Tab, 10 Ref.

Descriptors: *Sand filters, *Drinking water, Reservoirs, *Public health, Filtration, Water supply, Water resources development, Dams, *North Cameroon, *Cercarial control, Schistosomes, Literature reviews, Water treatment.

A literature survey was conducted on past filtration studies in order to determine methods to aid in the control of cercariae of human schistosomes. Such health problems are matters of concern in the area of North Cameroon, as attempts are being made to provide water closer to villages through the construction of series of internationally and bilaterally financed dams built to impound water in reservoirs. From the literature survey it was determined that infiltration studies of the past often gave little information on sand characteristics and operating parameters. There were no indications in the papers reviewed that filter rates were ever controlled. A better designed and controlled filtration study was therefore conducted. The results of these tests dictated the selection of sand grains of uniformity coefficient less than 2.0 and effective size of 0.3 mm or less. The filter was designed at 1.2 m initially. During its period of use it may be scraped down in depth, but never to a depth less than 0.6 m. The infiltration rate must be controlled. The design rate was selected to be 0.12 m/hr. All filters are to be thoroughly conditioned before being placed on line, and at no time should the sand bed be allowed to be without water. Field capability for microbiological quality testing was incorporated into the project. Where needed, a simple chlorination process will be added in the treatment train to provide multiple barriers to assure water quality. (Baker-FRC)
W83-02790

COMPUTER-BASED TELEMETRY MONITORS WATER USE,
Public Works, Vol 113, No 12, p 40-41, December, 1982.

Descriptors: *Computers, *Control systems, *Water consumption, Automation, Reservoirs, Monitoring, South Coast County Water District, California, Remote sensing, Water demand, Water level, Water supply, Water flow, Water distribution, Water use.

A computer system monitors, controls, and records water flow for the South Coast County Water District, south of Los Angeles, California. The local district has no direct control over supplies, which come from the Metropolitan Water District (MWD). If changes in demand are expected, a 24-hour notice must be given to the MWD. Daily consumption varies widely and unpredictably from 2 to 6 million gallons. The system uses two 16K minicomputers, 2 CRTs, 3 printers, and telemetering equipment. Measurement of the storage reservoir level is used to automatically operate pumps. Alarm systems include signals for high level, low level, and danger. Data, including water levels and pump discharge pressures, are used to accurately predict future water demands on a daily basis. A variety of hard-copy reports is generated. (Cassar-FRC)
W83-02794

COMPUTER ASSISTED ANALYSIS TO IMPROVE WATER SYSTEM OPERATION,
CH2M/Hill, Seattle, WA. Water and Waste Div.
D. C. Martin.
Water/Engineering and Management, Vol 129, No 11, p 8-9, 1982. 1 Fig.

Descriptors: *Water distribution, *Model studies, *Computers, Water conveyance, Pipelines, Water supply, Pumps, Cost analysis, Wells, Management, Decision making.

A typical computer assisted analysis is based on a mathematical model of the water system. The model simulates pipelines, pump stations, reservoirs and regulating valves. Operational conditions such as demand, supply rate and head, and reservoir water level are imposed on the model. The computer program processes the data and calculates system pressure, water velocity and head loss in the pipelines. When a water utility must change from a multiple well supply system to a single source supply, the operating conditions are significantly changed even without increased demand. The effects of a new single supply connection on the distribution system include high head losses in the pipelines near the supply, resulting in low service pressures. The most costly potential effect is that distribution and storage facilities will no longer be properly situated to be compatible with the new supply. Applications of computer analysis are also considered briefly for situations of power management, supply flow constraints and pump efficiency. (Baker-FRC)
W83-02799

5G. Water Quality Control

RESPONSIBILITY FOR RUNOFF CONTROL,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W83-02467

THE ROTSEE - AN EXAMPLE OF A LAKE IN WHICH WATER POLLUTION CONTROL MEASURES WERE SUCCESSFUL (DER ROTSEE - EIN BEISPIEL FUR EINEN SEE, BEI DEM DIE GEWASSERSCHUTZMASSNAHMEN ERFOLGE BRACHTEN),
Luzern Kantolales Amt fuer Gewasserschultz (Switzerland).
P. Stadelmann.
Wasser, Energie, Luft, Vol 74, No 1/2, p 12-13, January/February, 1982. 1 Fig, 2 Tab, 1 Ref. (No English Summary).

Descriptors: *Eutrophic lakes, *Phosphorus, *Water pollution control, *Wastewater treatment, *Lake restoration, *Switzerland, Rotsee, Lucerne, Oxygen, Destratification, Rehabilitation.

The causes of eutrophication of the Rotsee (Lucerne, Switzerland) are described, together with measures undertaken to improve its condition, some of which were eventually successful. Discharge of wastewaters from the city of Lucerne into the lake began in 1850, and pollution by nutrients resulted in visible algal blooms by 1910, while the first chemical analysis in 1916 showed only 1 mg oxygen/l at depths of 0-10 m. The lake was eutrophic by 1920. In 1921-22, a canal was built to introduce 400 l/sec water from the Reuss river to the Rotsee, and a mechanical wastewater treatment facility to serve 900 inhabitants was constructed. When no improvement in water quality occurred, a second plant to serve 7,300 inhabitants was built in 1933. Since 1974, no wastewaters have been discharged into the lake, and the quality of the Reuss has improved due to new wastewater treatment facilities in the city of Lucerne. Investigations of the Rotsee in 1920-23, 1930, 1949, and 1969-70 revealed no improvement in water quality, but this trend was reversed in 1978-79. Whereas in 1970 500 mg phosphorus/cu m was measured during spring turnover, this level was below 100 mg phosphorus/cu m in March 1981. Improvements were also seen in minimal visual depth and oxygen levels, while fish were able to survive in larger areas. Despite these improvements, the present phosphorus input is twice the desired level of 350 kg/yr for a 90-m-deep lake with a water retention time of 0.4 yr. (Gish-FRC)
W83-02504

ORGANIC CHEMICAL FIRE IN ILLINOIS: EMERGENCY RESPONSE AND CLEANUP,
Illinois State Environmental Protection Agency, Springfield.
W. H. Busch, and J. Reinkes.
Civil Engineering (New York), Vol 52, No 9, p 62-65, September, 1982. 1 Tab.

Descriptors: *Agricultural chemicals, *Chemical wastes, *Soil contamination, *Organic compounds, Fires, Emergencies, Pesticides, *Chemical wastewater, Spills, Waste disposal, Waste treatment, Wastewater treatment, Water pollution prevention, Neutralization, Soda ash, Activated carbon, Degradation, Soil treatment, Lagoons, Hillsboro, *Illinois.

A fire at the Hewitt-Ware Feed and Supply Company agricultural chemical warehouse at Hillsboro, Illinois, on April 23, 1980, produced 250,000 gal of contaminated firefighting water as well as contaminated fire debris and soil. Twenty-one chemicals of differing toxicity had been stored in the warehouse. Immediate damage to the groundwater and surface water was mitigated by the natural swales in the land and the hastily constructed retention dams, which contained the waste, and by the underlying layer of low-permeability blue clay. Contaminated water discharged through storm sewers to a nearby creek was temporarily contained by a bentonite-lined sand bag dam. This water was pumped into a quickly constructed 300,000 gal membrane-lined pit adjacent to the creek for storage and subsequent treatment with soda ash and activated carbon (1000 mg per liter dose). Because of the complex mixture of chemicals and difficulties with analysis, 72 hour static bioassays with fingerling perch were used to determine if the water had been sufficiently detoxified to return to the creek. Sludge produced from the flocculation process was disposed of in a landfill. Unburned products were placed in sealed drums and burned drums were placed in overpack drums for disposal in a hazardous waste landfill. The most heavily contaminated soil was removed to the landfill. The remainder of the debris-cleared site was treated with soda ash and powdered activated carbon to absorb toxic substances and encourage natural degradation processes. (Cassar-FRC)
W83-02516

RESTORATION OF THE CENTRAL LAKES: BALDEGGERSEE, HALLWILERSEE, AND SEMPACHERSEE. GENERAL OVERVIEW (DIE SANIERUNG DERMITTELLANDSEEN: BALDEGGERSEE, HALLWILERSEE UND SEMPACHERSEE. ALLGEMEINER UBERBLICK),
Luzern Kantolales Amt fuer Gewasserschultz (Switzerland).
P. Baumann.
Wasser, Energie, Luft, Vol 74, No 1/2, p 13-14, January/February, 1982. (No English Summary).

Descriptors: *Eutrophic lakes, *Lake restoration, *Phosphorus removal, *Water pollution control, *Planning, Aeration, Water circulation, Wastewater treatment facilities, Sludge disposal, Agriculture, Rural areas, Regulations, *Switzerland, Sempachersee.

Methods of restoring the eutrophic central Swiss lakes Baldeggersee, Hallwilersee, and Sempachersee are described, using as an example a four-step plan developed for Sempachersee. The principal cause of eutrophication is phosphorus; the annual phosphorus load of Sempachersee is 15 tons (7 tons from wastewater treatment plants and urban and rural areas not served by these facilities, 7 tons from agricultural areas, and 1 ton from the atmosphere and precipitation), whereas it should lie below 4 tons. The first stage of the plan is directed toward urban areas, where wastewater treatment plants which phosphorus precipitation are in use. The boroughs are obligated to ensure that all households are hooked up to the sewers, while the cantons are responsible for monitoring the quality of treated wastewater released into the lake. Rural areas, dealt with in stage two of the plan, often release raw or partially treated wastewaters containing phosphorus to the lake. The discharge points must be located and treated individually. For the agricultural areas (stage three), an assessment was made in 1979 of agricultural pollution of the lake's catchment area with emphasis on phosphorus, and in 1981 all farmers in this area received general and individually oriented information on this subject. The fourth stage concerns measures conducted within the lake: aeration, artificial circulation in winter, and extraction of 1.1 cu m/sec of polluted water from a depth of 80 m. None of these measures are yet in effect. (Gish-FRC)
W83-02558

VALUE OF INDIVIDUAL HOUSEHOLD WATER SUPPLIES IN THE MAINTENANCE PHASE OF A SCHISTOSOMIASIS CONTROL PROGRAMME IN SAINT LUCIA, AFTER CHEMOTHERAPY,
National Inst. for Medical Research, London (England). Div. of Parasitology.
P. Jordan, G. O. Unrau, R. K. Bartholomew, J. A. Cook, and E. Grist.
Bulletin of the World Health Organization, Vol 60, No 4, p 583-588, 1982. 5 Tab, 11 Ref.

Descriptors: *Public health, *Potable water, *Sanitation, *Human diseases, *Developing countries, Rural areas, Benefits, Cost analysis, Infection, Drinking water, Water supply development, Sanitary engineering, *Saint Lucia, *Schistosomiasis.

The effect of providing individual household water supplies and community laundry shower units on the transmission of Schistosoma mansoni was studied in five villages in Richefond valley in Saint Lucia. Between 1970 and 1975, the incidence of new infections among children 0-10 years of age declined from 31 to 12.6%. From 1975 to 1977, chemotherapy with oxamniquine was offered to persons still found to be infected. Transmission of the disease remained low for the next four years, with no sign of an increase, despite poor sanitation in the villages. It was concluded that properly maintained drinking water supplies contribute substantially to the reduced transmission of schistosomiasis in a comprehensive control program. Sporadic new infections were found mostly among children, but these were associated with minimal morbidity. Detailed cost records for maintaining water supplies and providing chemotherapy programs in the villages were kept. (Geiger-FRC)
W83-02561

URGENT PROBLEMS OF CONSERVATION AND RATIONAL USE OF WATER RESOURCES,
A. B. Avakyan, and V. S. Kaminskii.
Hydrotechnical Construction, No 2, p 148-152, February, 1980. 10 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 2, p 24-26, February, 1980.

Descriptors: *Reservoirs, *Water management, *Water reuse, Water quality control, Wastewater treatment, Self-purification, Industrial wastewater, Municipal wastewater, Water conservation, Recycling, Regional planning, Zero-discharge, Planning.

Conservation and improvement of water quality is an increasing concern of water resource development planners in the USSR. Reservoirs decrease river current velocities, self-purification, mixing, and dilution of wastes. Protection of water bodies must consider not only the water itself, but processes occurring in the drainage basin and in the littoral zone. The current water quality policies in the USSR emphasize industrial use of closed water supply cycles and zero-waterand zero-waste technologies. In 1976 recycled water amounted to 68% of total water used in industry. Complex technical problems must be solved before 100% water recycling is possible: handling of mineral pollutants, sufficient disinfection of municipal wastewaters, and control of farm runoff. Planning for preserving water quality of reservoir systems should be on a

regional basis, recognizing that distinctly different masses of water can exist within a single reservoir. Possible means of altering water bodies include: engineering measures (embankments, etc.) to create independent regimes, removal of excess organic matter or addition of fertilizers to change the trophic state, aeration of water, creation of water protection and buffer zones, and controlled formation of ecosystems. To avoid conflict among the different branches of the economy (fisheries, recreation, agriculture, industry, etc.) it is important to coordinate water quality improvement projects. (Cassar-FRC)
W83-02623

THE ROLE OF BENTONITE IN SOIL SEALING APPLICATIONS,
International Minerals and Chemical Corp., Des Plaines, IL.
G. R. Alther.
Bulletin of the Association of Engineering Geologists, Vol 18, No 4, p 401-409, November, 1982. 3 Fig, 6 Tab, 14 Ref.

Descriptors: *Bentonite, *Groundwater pollution, *Water pollution control, *Waste dumps, Infiltration, Permeability, Covers, Liners, Hazardous wastes, Solid wastes.

The types of bentonite, installation practices, and testing methods employed when using bentonite in soil sealing applications are considered. Leachates are generated in solid waste disposal sites when water is allowed to infiltrate the site. The degree of groundwater contamination is related to the degree of leaching, and depends on the hydrogeology of the area and on the attenuation capacity of the soil. Swelling bentonite has gained prominence in waste isolation projects in the last few years. By admixing swelling bentonite with soils of high permeability, the coefficient of permeability can be drastically reduced. The bentonite is either deposited over the soil as a pure blanket and covered with soil, or mixed into 5 to 15 cm of soil as a mixed blanket. However, the pure blanket method is subject to puncture and subsequent leaking. In addition to landfill liners, slurry trenches may also be constructed using bentonite slurry to seal off a waste site from groundwater. The compatability of bentonite with wastes is good, and the swelling of bentonite can be increased by adding a polymer of the sodium polyacrylate and acrylonitrile type. It is very important, however, that the bentonite in all sealing applications be prehydrated with fresh water upon installation to improve its resistance to contaminants. (Baker-FRC)
W83-02662

EVALUATION OF THE SUCCESS OF NUTRIENT-ELIMINATION MEASURES IN WATERS WITH A HIGH NUTRIENT CONTENT (BEWERTUNG DES ERFOLGES VON NAHRSTOFFELIMINIERUNGSMASSNAHMEN AN STARK BELASTETEN GEWASSERN),
Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden- und Lufthygiene.
G. Klein, and R. Kuhn.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 3, p 136-143, June, 1982. 10 Fig, 4 Ref.

Descriptors: *Nutrient removal, *Lake restoration, *Evaluation, *Water use, *Phosphorus removal, Eutrophic lakes, Grunewaldseen, Berlin, *Federal Republic of Germany, Phoshates, Oxygen, Biomass, Algae, Phytoplankton, Oxidation-reduction potential, Seasonal variation, Chlorophyll, Water Quality.

Elements necessary for a successful program of investigation to document the effects of surface-water restoration are discussed with particular reference to the goals for water use. The lower Grunewaldseen in Berlin (Federal Republic of Germany) are used as an example. The input of nutrients into the Schlachtensee with water from the Wannsee is largely responsible for marked eutrophication. The effect of a phosphorus (P) elimination plant for lake restoration will be assessed over a two-year period. The influence of climate and sources of nutrients other than Wannsee water is important for the assessment of the program's effect on P levels. It was assumed that after restoration the amount of mobile P in the hypolimnion will be limited during summer stagnation when oxygen consumption in the sediment-water contact zone will be slowed and that reduced P input in fall will not compensate for P precipitation during circulation as much as before. The observed reduction of nitrogen in Schlachtensee would result in a change in phytoplankton population distribution if the program were successful, as well as a reduction in primary production and an associated improvement in oxygen balance and water quality. (Gish-FRC)
W83-02688

DISTURBANCE OF WATER PURIFICATION PROCESS BY ALGAE, ESPECIALLY DURING THE INFILTRATION OF A BIOLOGICALLY ACTIVE SURFACE WATER (BEEINTRACHTIGUNG DER WASSERREINIGUNG, INSBESONDERE BEI DER INFILTRATION EINES BIOLOGISCH HOCHAKTIVEN OBERFLACHENWASSERS),
Dortmunder Stadtwerke A.G. (Germany, F.R.).
K. Schmidt.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 3, p 143-151, June 1982. 14 Fig, 11 Ref.

Descriptors: *Artificial recharge, *Induced infiltration, *Algal control, *Drinking water, *Rivers, Ruhr river, *Federal Republic of Germany, *Sand filters, *Self-purification, Flow velocity, Storage reservoirs, Phosphorus elimination, Flocculation, Potassium compounds, Biomass, Primary productivity, Algal growth, Chlorophyll a, Slow sand filters, Groundwater recharge.

Impairment of water purification by algae occurred in the middle Ruhr area of the Federal Republic of Germany where drinking water was obtained through artificial groundwater recharge. Algae developed in slow sand filters when biologically active river water was used for recharge. The Dortmund facility avoided the problem by using a coarse gravel filter followed by aeration cascades. These are operated intermittently to avoid algal growth in the infiltration basin--a slow sand filter. Finally, the water runsthrough a 50-m long underground passage where it remains less than 12 hr. Methods that can be used to prevent algal mass development during artificial recharge include intermittent filter operation on a 24-28 hr rhythm, phosphorus elimination by flocculation, and continous dosing of 1 to 1.5 mg/liter of potassium permanganate. (Small-FRC)
W83-02717

FEASIBILITY OF INACTIVATING PHOSPHORUS WITH ALUMINUM SALTS IN BALL POND, CT,
Connecticut Agricultural Experiment Station, New Haven.
W. A. Norvell.
Bulletin 806, September 1982. 10 p, 5 Fig, 5 Tab, 14 Ref.

Descriptors: *Phosphorus, *Aluminum sulfate, *Alum, *Eutrophication, *Lake restoration, Algal growth, Nitrogen, Retention time, Alkalinity, Hydrogen sulfide, Fish populations, Sediment-water interface, Oxygen demand, *Connecticut, Ball Pond.

Ball Pond's characteristics and watershed suggest that reduced phosphorus (P) concentrations would greatly restrict algal growth, reduce eutrophication and increase the lake's value as a recreational and fishery resource. The study's objectives were to confirm the lake's suitability for treatments to inactivate P and to determine the forms and amounts of P susceptible to inactivation, the proportion of P from external vs. internal sources, the choice of aluminum (A1) salts and application rates, how much of the lake would need treatment, and if treatment would damage the fish population. Field studies confirmed its eutrophic status: in 1979, nitrogen (N) and P were fairly high, hypolimnetic oxygen was consumed rapidly, hydrogen sulfide was found in most of the hypolimnion, and chlorophyll-a concentrations and algal numbers were high. Ball Pond is well-suited to treatment by aluminum salts to inactivate phosphorus. Most P in the lake becomes concentrated in the hypolimnion during summer stratification and a large proportion is present as easily precipitated inorganic phosphate. Treatment of the hypoliminion with liquid alum in late summer or early fall would probably remove one-half of the lake's total P, an amount greater that the estimated annual supply for external sources. Applying about 85,000 kg of liquid alum would provide the desired addition of Al. Benefits from treatment should be relatively long-lasting because of the large fraction of phosphorus removed and the five-year water retention time. In late summer and fall the form of P most susceptible to inactivation is concentrated in a region where desirable fish species would not be present. (Atkins-Omniplan)
W83-02718

FURTHER ACTION BY THE CANTONS. AARGAU CANTON (DAS WEITERE VORGEHEN DER KANTONE. KANTON AARGAU),
Kanton Aargau, Aarau (Switzerland). Abt. Gewasserschutz.
E. Marki.
Wasser, Energie, Luft, Vol 74, No 1/2, p 14-15, January/February 1982. (No English Summary).

Descriptors: *Lake restoration, *Lake sediments, *Aeration, *Phosphorus removal, *Project planning, Water pollution control, Water Quality control, Costs, *Switzerland, Hallwilersee, Fertilizers, Agriculture, Aerobic conditions, Water circulation, Deep water.

The efforts of the Aargau canton, Switzerland, to reduce pollution in the Hallwilersee are described. Aargau is only partially responsible for the cleanup, sharing planning and costs with the Lucerne canton. Earlier efforts were centered on keeping wastewater pollution out of the lake, and this goal has almost been reached since 1964, when the Seengen wastewater treatment facility became operational. Phosphorus is not revoved by chemical precipitation, but by drainage below the lake outlet. The two main sources of phosphorus in the Hallwilersee, apart from the inflow from the Baldeggersee, are eroded material from cultivated land and redissolved lake sediment. The canton is presently eliminating phosphorus from sediment almost entirely by the year-round introduction of oxygen into the deep water at the rate of 6-10 g/1,0001 water. This oxygenation also allows normal fish life and breeding. Pollution with unused fertilizer from arable land cannot be cured completely with technological means; different fertilization processes must be adopted, and more land susceptible to erosion must be turned over to pasture. A competition set up by the Argau and Lucerne cantons for projects for the restoration of the Hallwiler-, Baldegger-, and Sempacherseen showed that there are several methods of oxygenating deep water. The one selected for pilot study, based on cost and projected durability, was the Tanytarsus procedure. Operation is expected to begin in 1985. Goals for the project are aeration of the hypolimnion with forced circulation in winter; at a permanent phosphorus content of 11.4 tons/yr, this is expected to produce constantly aerobic conditions within six years. (Gish-FRC)
W83-02758

FURTHER ACTION BY THE CANTONS. LUCERNE CANTON (DAS WEITERE VORGEHEN DER KANTONE. KANTON LUZERN),
Luzern Kantolales Amt fuer Gewasserschultz (Switzerland).
P. Baumann.
Wasser, Energie, Luft, Vol 74, No 1/2, p 15-16, January/February, 1982. (No English Summary).

Descriptors: *Lake restoration, *Aeration, *Project planning, *Costs, *Pilot plants, *Switzerland, Baldeggersee, Sempachersee, Hallwilersee, Oxygen, Construction costs, Economic aspects, Government supports, Water pollution control, Water quality control, Water circulation, Deep water, Water transfer.

The Lucerne (Switzerland) canton's plans for the restoration of the Baldeggersee, Sempachersee,

and Hallwilersee (for which it is jointly responsible with the Aargau canton) are described. A canton-supported competition to obtain projects for this purpose turned up a simple and inexpensive procedure for deep-water aeration and forced circulation. The Tanytarsus procedure requires a distribution station on the lake bank, from which pure oxygen is dispensed to the deep strata through a pipeline network anchored to the lake bed. There is no need for large, unsightly structures. Tanytarsus is being tested in the Baldeggersee, chosen as the experimental lake because of its sheltered position (it has no ship traffic or other outside disturbances), because its depth lies between that of the other two lakes, and because current measurements have been made there. If the test is successful, the procedure will also be used in the Sempacher- and Hallwilerseen; it is therefore important that the cantons of Lucerne and Aargau cooperate and share costs equitably. Test aeration was scheduled to begin in the spring of 1982 and last about one year; installations were to be constructed so that they could form part of a permanent facility. Draining off of deep water is not forseen for Baldeggersee, but a feasibility study for this is to be conducted for Sempachersee. An alternative project for Sempachersee would involve connecting the lake with the Reuss river, so that water could be transported back and forth. The height difference between the lake and the river would permit the construction of a power station. The water renewal time of the lake would theoretically be reduced from 17 to 4-6 years. Improvement in water quality would result even without aeration. This project would cost about 36 million Francs. The high cost, together with legal considerations, are barriers to the realization of this plan, and deep-water aeration needs to be instituted without delay. (Gish-FRC)
W83-02759

CUBELLES THERMAL POWER PLANT-A NEW SOLUTION FOR THE INTAKE AND DISCHARGE OF COOLING WATER (CENTRA TERMICA DE CUBELLES-UNA NUEVA SOLUCION PARA LA TOMA Y DESCARGA DE AGUA DE REFRIGERACION),
Madrid Univ. (Spain).
For primary bibliographic entry see Field 8A.
W83-02795

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MODEL SELECTION IN MULTIOBJECTIVE DECISION MAKING FOR RIVER BASIN PLANNING
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
L. Duckstein, M. Gershon, and R. McAniff.
Advances in Water Resources, Vol 5, No 3, p 178-184, September, 1982. 2 Fig, 4 Tab, 34 Ref.

Descriptors: *Water resources development, *River basins, *Planning techniques, Decision making, Management, Model studies, ELECTRE, Compromise programming, Multiattribute utility theory, Santa Cruz River, *Arizona.

Appropriate model selection among three alternative multiobjective techniques was explored using an example of river basin planning. The site of the study was the main stem of the Santa Cruz River near Tucson, Arizona. The three techniques are ELECTRE, compromise programming and multiatribute utility theory (MAUT). Important questions in the selection process concern the type of data required, the necessary amount of interaction between the decision maker and analyst, and the nature of the problem. Such characteristics are used as criteria to demonstrate whether or not a particular model can be successfully applied. Based on the computations obtained it is concluded that compromise programming is the most appropriate model for application to this problem. In compromise programming and in the ELECTRE procedure a scaling procedure is used to convert qualitative to quantative data, while MHUD requires development and assessment of a utility function. Compromise programming can be applied to both discrete and continuous data. Differences in the application of the discordance concept cause differences in the consistency of results obtained. All the methodologies tested were fairly robust with respect to changes in parameter values. (Baker-FRC)
W83-02650

6B. Evaluation Process

THE ECONOMIC EFFICIENCY OF FLOOD PLAIN DEVELOPMENT,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6F.
W83-02477

THE ECONOMIC IMPACTS OF ALTERNATIVES AND CONTINGENCIES RELATING TO THE 1978 DECISIONS OF THE MONTANA BOARD OF NATURAL RESOURCES ON WATER RESERVATIONS IN THE YELLOWSTONE BASIN,
R. J. McConnen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186460, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Report No 126, Bozeman, January 1983. 21 p, 2 Fig, 3 Tab, 13 Ref. OWRT A-125-MONT(1), 14-34-0001-0128.

Descriptors: *Linear programming, *Water allocation(Policy), *Irrigation, *Return flow, Irrigation efficiencies, Water law, Runoff low flow, Yellowstone River, Return flow coefficients, Winters doctrine, Alternative allocations, *Montana.

A linear programming (L.P.) model for the Yellowstone Basin which is partitioned into nine sub basins and six time intervals has been developed and the data required to use the model has been collected. One of the major problems which was solved before the general L.P. model could be used was to develop realistic return flow coefficients for each of the nine sub basins and for each of the six time intervals. The return flow coefficients were estimated in a manner which was consistent both with the general theory about return flows and the seasonal pattern of stream flow which is generated within each sub-basin for each of the six time intervals. The methodology used to generate estimates of return flow coefficients was designed to be a general methodology and should be usable in many other water resource situations. The general L.P. model will be used to deal with a series of policy related issues including the impact of increased efficiencies on late season flows, especially during low flow years. The impact of alternative allocations of the Yellowstone water will be analyzed along with the impact of the levels of prices received on the marginal value of water.
W83-02493

ECONOMIC ISSUES IN RESOLVING CONFLICTS IN WATER USE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W83-02501

VALUATION OF INTANGIBLES: THE CASE OF WATER QUALITY,
Massachusetts Univ., Amherst. Dept. of Agricultural and Resource Economics.
C. E. Willis, J. H. Foster, and K. Sewall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191874, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 133, Massachusetts University, Amherst, January 1983. 115 p, 9 Fig, 10 Tab, 37 Ref, 4 Append. OWRT B-076-MASS(1), 14-34-0001-9151.

Descriptors: *Water value, *Property value, Water pollution control, *Water quality, *Environmental quality, *Environmental protection, *Connecticut River Basin, Econometrics, Depreciation, Elasticity of demand, Land appraisals, Value, Economic development, Economic impact, Pollution effects, Market value, *Massachusetts.

The hedonic technique has been advanced in the last several years as an important research tool for assessing the value of environmental attributes not subject directly to market forces. In its most usual form, the method involves attempting econometrically to capture differential prices for homes due to variations in the environmental characteristics. It has been applied successfully for a variety of attributes--perhaps most notably the study of air pollution. However, the two case studies of water quality improvement reported in this study appear not to have increased prices paid for real property. The authors advance several possible reasons to explain the failure of the hedonic approach in these cases, including likelihood that prospective property purchasers may be unaware of specific water quality improvements and likelihood that changes in supply and demand for housing obscure the impact on price of amenity improvements.
W83-02732

RECREATION IN THE PERCEIVED COMMUNITY FUNCTION PERSPECTIVE,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
B. F. Blake, J. T. O'Leary, and M. B. Adams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191932, Price codes: A03 in paper copy, A01 in microfiche. Purdue University Agricultural Experiment Station Bulletin No 351, November 1981. 37 p, 4 Fig, 4 Tab, 69 Ref, 2 Append. OWRT A-999-IND(8).

Descriptors: *Outdoor recreation, *Recreation facilities, *Community function, Recreation, *Attitudes, Public opinion, *Recreation demand, *Surveys, Evaluation, Social values.

This survey shows that the individuals judgments of the value of outdoor recreation facilities are multidimensional. The dimensions evaluated were (1) individualistic vs. community wide, (2) the change vs. stability continuum, and (3) the primary vs. secondary function. The data suggested that people used these three dimensions or yardsticks in judging the value of outdoor recreation. The overall value that people saw in outdoor recreational facilities was determined by how well outdoor recreation facilities simultaneously 'measured up' against all three of these yardsticks.
W83-02740

AN EVALUTION FRAMEWORK FOR ASSESSING VARIATIONS IN THE COSTS AND BENEFITS OF MUNICIPAL WATER CONSERVATION,
INTASA, Inc., Menlo Park, CA.
W. B. Betchart, F. Floridis, B. Jones, and S. Postel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191965, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, December 1981. 136 p, 14 Fig, 30 Tab, 45 Ref. OWRT C-00010-C (No 0485)(1), 14-34-0001-0485.

Descriptors: *Municipal water conservation, *Water conservation, Water supply savings, Wastewater treatment savings, *Community water conservation, Economics, *Cost-benefit analysis, *Engergy savings, Water resources planning, Conservation case studies, Net benefits.

A method is presented for quantifying municipal water conservation's costs and benefits to the community. Community characteristics such as population growth rates, ambient water supply temperature and water heater fuel type and price were examined to determine their influence on overall costs and benefits of municipal water conservation. Three case studies were performed to apply the method to 'real life' situations. Municipal water conservation was found to be an economically efficient water management strategy in diverse sets of circumstances. Although economically justifiable in many settings, the sources of economic

benefits varied greatly. In the case studies examined, water supply utility savings ranged from 1.4 to 20 percent of total dollar savings as a result of a water conservation program. Wastewater treatment savings ranged from 2.6 to 56 percent of total savings. Hot water energy savings were the most consistent savings component, comprising at least 40 percent of total savings in each of the case studies. Further findings indicate that communities with little or no excess capacity in its water supply and wastewater treatment facilities will find water conservation economically beneficial. Annual population growth rates and the water conservation economically beneficial. Annual population growth rates and the water demand and wastewater flow peak factors appear to substantially influence water conservation's net benefits to the community. The ambient water temperature and fuel price and type, which affect the cost of heating water to the temperature desired for use, appear to have more modest effects on the benefits of municipal water conservation. The level of water demand and wastewater flow reductions actually achieved by the water conservation program were found to have dramatic effects on the program's net benefits.
W83-02743

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

RATE STRUCTURE ALTERNATIVES FOR UTILITIES,
J. J. Gall, and T. S. Catlin.
Public Works, Vol 113, No 6, p 39-43, June, 1982.

Descriptors: *Water costs, *User charges, *Sewage rate, Costs, Water conservation, Water use, Water metering.

As large scale system oversizing becomes less practical and as water conservation becomes more important, several new pricing policies for water service are becoming more popular. Service charges are fixed charges designed to recover the costs required to supply customers with meters, service lines and other billing expenses. Uniform rates ensure that all customers pay at an equal rate. Under increasing block rates, progressively larger increments of usage are sold at successively higher rates during the billing period. Increasing block rates are usually used where water conservation is of critical concern. Seasonal surcharges may be applied to the base water rate in areas where water becomes seasonally scarce. When a municipal water service provides water service to a neighboring community, it is best done under a contract. A high degree of correlation exists between water service charges and sewer rate structures. In the early 1970's, the EPA construction grants program forced changes in sewer rates methodology and required proportional charges for all users. Retail sewer rates are often based on infiltration and flow, which means greater costs for heavier water users. Some problems with direct measurements for retail charges exist in seasonal communities and places where non-returned use is high. Like water rates, wholesale sewer rates are often the same as, or multiples of, rates charged to retail customers, a system that ignores wastewater quality. Apportioning costs between wholesale and retail customers according to water quality considerations is discussed. (Geiger-FRC)
W83-02473

THE EFFECTS OF WATER CONSERVATION ON NEW WATER SUPPLY FOR URBAN COLORADO UTILITIES,
Colorado Univ. at Boulder. Dept. of Civil, Environmental, and Architectural Engineering.
For primary bibliographic entry see Field 3D.
W83-02500

SEEKING CONSUMERS COOPERATION IN THE FINANCING OF WATER SUPPLY (CONDITIONS PERMETTANT AUX CONSOMMATEURS A RESSOURCES LIMITEES DE PARTICIPER AU FINANCEMENT DE LEUR CONSOMMATION D EAU),
Caisse Centrale de Cooperation Economique, Paris (France).
H. Le Masson.
Aqua, No 3, p 263-266, 1981.

Descriptors: *Water conveyance, *Maintenance costs, *Operating costs, *Metropolitan water management, Economic aspects, User charges, Water distribution, Developing countries, Investment, *Africa, Carribean.

A procedure which can be used to finance the maintenance and operating costs of the water supply service by consumers even in capital-poor countries is presented. First, the responsibilities of the government and of the water supply company must be well defined. Second, the water supply company must have improved organizations and management adapted to local conditions. The different characteristics of urban, town, and village water systems must be kept in mind in planning. (Small-FRC)
W83-02634

DRINKING WATER AND ITS PRICING (EAU POTABLE ET TARIFICATION),
Societe Lyonnaise des Eaux et de l'Eclairage, Paris (France).
G. Facy.
Aqua, No 3, p 271-273, 1981.

Descriptors: *Water conveyance, *Water distribution, *Water costs, *Water management, Resources management, Public policy, Water policy, Water demand, Water supply, Public relations, Policy making.

Water industry data are needed in order to properly manage water supplies and determine reasonable charges for water use. Reasons for assembling this information are different in every country and depend on organizational structure and the responsibilities of the national water industry. A comprehensive survey of water resources should be prepared from all information sources including the government, water supply associations, and scientific and research institutes. Total supply figures for a country are not sufficient. Data are needed on supply areas, political districts, and catchment areas. Long-term surveys are necessary for systematic planning to meet future water demand. Occasional specific reports are not sufficient. An active information policy is suggested for government institutions and private organizations, to provide the public with economic and technical information on the nation's water supply. The reasons for variations in water charges such as different patterns of consumption and different types of charges should be explained to the public. (Small-FRC)
W83-02652

MUCH MORE TO RATES THAN TRADITION,
Camp, Dresser and McKee, Inc., Boston, MA.
C. Woodcock.
Water/Engineering and Management, Vol 129, No 11, p 24-25, 1982.

Descriptors: *Water rates, *Pricing, Decision making, Management, Water supply, Economic aspects, Municipal water supply.

In an effort to update the water-rate structure for a given municipality, a study was made to determine what procedures had been used in the past and what the best approach to the future might be. In the past this municipality has used a three-block, declining-rate schedule with minumum charges and allowances. Various methods have been developed over the years to determine an optimum water-rate schedule for any given community. Such solutions have extolled the virtues of marginal cost pricing, increasing block rates, decreasing block rates, uniform rates, life-line rates, and others. Economic realities change rates, and local economic conditions should be considered in making any changes. Protecting the small water user must be kept in mind. Deviations from pure cost-of-service principles in order to meet the operating goals of the water utility are valid considerations as well. Existing contracts which may have some clauses concerning how a municipality will charge for its water use must be examined. (Baker-FRC)
W83-02781

6D. Water Demand

IMPACT EVALUATION OF INCREASED WATER USE BY AGRICULTURE IN MICHIGAN,
Michigan Agricultural Experiment Station, East Lansing.
J. F. Bartholic, R. L. Cook, F. M. D'Itri, D. B. Knezek, and M. L. Vitosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-190447. Price codes: A09 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State Univ., East Lansing, October 1982. 194 p, 49 Fig, 29 Tab, 131 Ref,1 Append. OWRT A-106-MICH(1), 14-34-0001-9024.

Descriptors: *Irrigation, *Crops, *Groundwater, *Recharge, *Riparian rights, Ecosystem, Water planning, *Michigan, Water law, Agricultural production, Corn, Soybeans, Great Lakes, Lakes, *Water use, *Consumptive use.

Irrigation, scientifically regulated, can increase the productive capacity of sandy soils. Probably 750,000 acres will be irrigated in Michigan by the year 2000. Most of the increase will be in central, southwestern, and southern Michigan on corn and soybeans, with the increased water used to come largely from underground sources. A need for further studies in surface supplies as related to soil characteristics and moisture modeling and crop coefficient studies is evident. Excessive water removal from small streams and shallow lakes during summer may lessen flow rates and seriously affect animal and plant activities in the water and on stream and lake bottoms. It may be advisable to limit water removal accordingly. Consumptive versus non-consumptive water use must be considered. Domestic use is nonconsumptive but contamination may be a hazard. In Michigan a license is not required for withdrawal of water for irrigation but the amount withdrawn must not exceed 'reasonable use', resulting disputes to be settled by a court of law. Navigable streams in Michigan may not legally be a source of irrigation; but if the 'reasonable use' doctrine is adhered to, a riparian owner may usually use such waters.
W83-02479

ECONOMIC ISSUES IN RESOLVING CONFLICTS IN WATER USE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. L. Gray, and R. A. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-189969, Price codes: A03 in paper copy, A01 in microfiche. Colorado Water Resources Institute Completion Report No 119, Colorado State University, Fort Collins, February 1983. 36 p, 17 Ref. OWRT A-037-COLO(1), 14-34-0001-8006.

Descriptors: *Economic aspects, *Water use, Value, *Prices, *Water allocation, Water resources development, Water management, *Colorado, Decision making, *Alternative uses, *Competing use.

One central and recurring theme underlies the concern of many agencies involved in water development and allocation decisions in Colorado. That theme is conflict in the use of economically scarce water supplies and appropriate means of resolving such conflict. One key economic ingredient in resolving conflicts among alternative uses is the value of water. An extensive literature search indicates that policy makers are not being provided consistent, comparable estimates of the social and economic significance of water in alternative uses. The reason is that water resource analysts have apparently reached no consensus on a systematic framework within which to estimate water values in the absence of observed market prices. The explanation lies in the failure of analysts to fully appreciate problems associated with the physical characteristics of the resource which may lead to

significant economic interdependencies, differences in the perspective taken in estimating water values, inadequately or inappropriately conceived concepts of use, variations in the techniques of analysis employed, and other factors. A conceptually consistent framework for valuing water is set forth. In addition two widely used analytical methods for valuing water are discussed. The residual imputation technique is found to be generally acceptable. However, the increasing reliance on valuation through the 'value-added approach' should be discouraged.
W83-02501

THE CREST DISPUTE: A MEDIATION SUCCESS,
Institute for Environmental Mediation, Seattle, WA.
V. C. Huser.
Environment, Vol 24, No 7, p 18-20, 36, September, 1982.

Descriptors: *Water resources development, *Planning, *Columbia river estuary, *Management, Estuaries, Estuarine environment, Port facilities, Environmental effects, Design criteria, Mediation.

Opposing priorities concerning appropriate use of the Columbia River Estuary and its shorelines in Clatsop County, Oregon, were recently settled through mediation. The mediation process was conducted by CREST (Columbia River Estuary Study Taskforce). By late 1980 the dispute had centered on the development and/or preservation of five specific sites in the estuary, and mediation was begun. Before negotiations of the issues could begin, ground rules had to be established. How any agreement would be achieved and formalized rather than what the agreement would contain were the major issues at the start of mediation. A matrix was proposed for each site, containing a detailed listing of each site, options for developing or maintaining that site, and criteria for each of the options. At this point the opposing sides were then able to engage in trade-offs. By the conclusion of the mediation sessions three levels of agreement were reached: an agreement on findings containing factual information that all parties would use in their deliberations and permit applications; an agreement on development designations which identified specific areas to be developed; and an agreement on subarea policies, which is a key element of the final agreement detailing the conditions under which development could occur in the appropriate areas specified in the agreement on development designations. (Baker-FRC)
W83-02532

THE DRAKENSBERG PROJECT: WATER AND POWER FOR SOUTH AFRICA,
Department of Water Affairs, Forestry and Environmental Conservation, Pretoria (South Africa).
T. P. C. Van Robbroeck.
Civil Engineer in South Africa, Vol 24, No 8, p 343-345, 347, 350-352, August, 1982. 8 Fig, 2 Tab, 6 Ref.

Descriptors: Water resources development, *Water supply, *Dams, Reservoirs, Planning, Management, Cost analysis, Decision-making, *South Africa, Drakensburg Project.

The planning of the Tugela-Vaal Scheme is outlined with particular reference to the Drakensberg Project, a major undertaking combining an 11 cubic meter/second inter-basin water transfer with a 1,000 MW pumped storage hydroelectric installation. Cooperation between the authorities responsible for water and those responsible for electricity supply resulted in a cost saving to the country of R50 million. The basis of this joint participation in the financing and construction of the scheme is described. Both phases of the scheme are now virtually in full operation, with more than 650 million cubic meters of water already stored at Sterkfontein Dam, ready to help towards overcoming the next drought. (Baker-FRC)
W83-02647

THE HUNDRED-YEAR EFFORT TO SECURE HONG KONG'S WATER SUPPLY (HUNDERTJAHRIGES BEMUHEN UM HONG KONG'S WASSERVERSORGUNG),
For primary bibliographic entry see Field 3B.
W83-02762

MORE CONFIDENCE IN PLANNING THROUGH CAPACITY STANDARDS FOR WATER SUPPLY SYSTEMS (MEHR PLANERISCHE SICHERHEIT DURCH DIE ABLEITUNG VON KAPAZITATSBEMESSUNGSGRUND LAGEN FUR DIE WASSERWIRTSCHAFT),
Munich Univ. (Germany, F.R.).
H. Fendt, and J. Ruhland.
Wasserwirtschaft, Vol 72, No 7/8, p 293-296, July/August, 1982. 4 Fig, 10 Ref. (English Summary).

Descriptors: *Water supply, *Stochastic process, *Water demand, Municipal water, Mathematical equations, Mathematical studies.

A method to derive capacity planning standards for water supply systems is developed. Daily water demand is regarded as a stochastic variable. The water supply system is said to fail if, on a day-to-day basis, the demand, the minimum capacity requirements can be derived immediately, once the maximum probability of failure that is acceptable has been decided upon. Employing quantitative risk analysis, this distribution function can be derived from historic data. The procedure for outlining the case of a large urban public utility company is cited. (Baker-FRC)
W83-02763

6E. Water Law and Institutions

RESPONSIBILITY FOR RUNOFF CONTROL,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
E. J. Rhomberg, and J. M. Mason, Jr.
Public Works, Vol 113, No 11, p 60-62, November, 1982. 4 Ref.

Descriptors: *Storm water, *Runoff, *Legislation, Legal aspects, Urban runoff, Water quality control, Water pollution control, Flood control, Drainage districts, Drainage, History, Ordinances, Building codes, Water law, Natural flow doctrine, Reasonable use, Civil law, Common enemy rule.

Legislation concerning control of storm water runoff can be traced back to the Commerce Clause of the Constitution's first article, which, broadly interpreted, would have given Congress power to regulate any activity. Several laws proved unworkable with respect to storm water discharges: Rivers and Harbors Act of 1899, Public Health Service Act of 1912, the Oil Pollution Act of 1924, and the Federal Water Pollution Control Act (FWPCA) of 1948. Later legislation included amendments to the FWCPA in 1956 and 1961, the Water Quality Act in 1965, and the Clean Water Restoration Act of 1966. The National Environmental Policy Act of 1969 was a significant law. Its most important provision was the requirement for environmental impact statements. Further amendments to the FWPCA in 1972 and 1977 regulated discharges into all waters, not just navigable waters. Aid to municipalities was provided by the Flood Control Acts of 1938 and 1960. Early drainage laws were aimed at increasing the amount of arable land and eliminating waterborne diseases. More recent laws are also concerned with harmful effects on groundwater and wildlife. Existing rules on surface runoff drainage are the common enemy rule, natural flow rule (a.k.a. civil law rule), and the reasonable use rule. Municipalities have no duty to construct storm drainage systems, although some states have imposed this responsibility. Subdivision laws shift the requirement for storm drainage to the developer. Subsequent maintenance fo the facilities is a subject of controversy. Municipal planning groups have considerable control over drainage through zoning and approval of development plants. Drainage districts, established as early as 1839, have powers varying with each state. Other forms of legislation affecting storm water runoff are zoning ordinances, building codes, and plumbing and sewer ordinances. (Cassar-FRC)
W83-02467

IMPACT EVALUATION OF INCREASED WATER USE BY AGRICULTURE IN MICHIGAN,
Michigan Agricultural Experiment Station, East Lansing.
For primary bibliographic entry see Field 6D.
W83-02479

EVALUATION OF THE RESULTS OF DRINKING WATER STUDIES ACCORDING TO APPENDIX 1 TO PARAGRAPH 3 OF THE DRINKING WATER ORDINANCE (AUSWERTUNG DER ERGEBNISSE VON TRINKWASSERUNTERSUCHUNGEN GEMASS ANLAGE 1 ZU PARAGRAPH 3 DER TRINKWASSERVERORDNUNG),
Baden-Wuerttemberg Landesanstalt fuer Umweltschutz (Germany, F.R.). Inst. of Seenforschungs Fischereiwesen.
For primary bibliographic entry see Field 5F.
W83-02618

A PUBLIC POLICY FOR HAZARDOUS WASTES,
Hofstra Univ., Hempstead, NY. School of Law.
W. R. Ginsberg.
Annals of the New York Academy of Sciences, Vol 387, p 39-45, 1982. 23 Ref.

Descriptors: *Hazardous materials, *Public policy, Waste disposal, Land disposal, Administration, Cost analysis.

Any comprehensive public policy directed to the problem of hazardous wastes must evolve from an understanding of its nature and scope, will require federal action, and will break new legal and governmental ground. It is estimated that 56 million metric tons of hazardous wastes are generated in the US each year. Major omissions in the hazardous waste policies at present have been highlighted by the recent experiences at Love Canal. The problem of paying for clean-up of hazardous waste sites has been borne, in some cases by area residents and in other cases by the public at large as industries generating the wastes have simply passed along the costs of clean-up to the consumer. Ways in which this charge might be shifted to the companies responsible for the wastes are explored. (Baker-FRC)
W83-02653

MAKE APPLICATIONS ACCORDING TO THE STATE WASTEWATER TAX LAWS ON TIME (DIE ANTRAGE NACH DEN LANDES-ABWASSERABGABENGESETZEN RECHTZEITIG STELLEN),
H. Keune.
Wasser, Luft und Betrieb, Vol 25, No 7/8, p 20-21, July/August, 1981. 2 Ref. (No English Summary).

Descriptors: *Water law, *Effluent charges, *Pollution taxes, Wastewater treatment, *Water pollution control, *Federal Republic of Germany, Settleable solids, Settling basins, Taxes, Legal aspects, Pollutant identification, Water quality control, Water quality standards.

Various deductions permissible under the Federal Republic of Germany's Wastewater Tax Law (WTL) are discussed. The deductions must be applied for in writing, and the various states have regulations governing the conditions under and time periods for which applications are granted. A reduction in units of pollution (UP) for which tax must be paid can be applied for by municipalities or industrial firms who possess a settling pond as a final treatment step attached to their wastewater treatment facility. As far as settleable solids are concerned, the various states have different rules regarding the use of gravimetry or volumetry for determining UP. Some states (e.g., Niedersachsen and Schleswig-Holstein) determine the number of UP gravimetrically at the taxpayer's request if the number of cu m/yr is more than five times as great

as the number of tons of dry matter/yr; other states (e.g., Hamburg, Saarland) only determine UP under these conditions for settleable solids with an organic matter content weight of less than 10%. Saarland adds that physical impairment of the receiving stream and impedance of maintenance thereof must be taken into acount when making a decision in this matter. Deductions for initial pollution of waters are not covered by law in some states (Baden-Wurttemburg, Niedersachsen); in others, initial pollution is determined on the basis of mean concentration and dilution factor of the water removed under consideration of expected changes in the quality of the water body from the which water was removed during a predetermined period not exceeding five years. If the state has set standards for initial pollution, these are adhered to; otherwise, initial pollution is individually determined. (Gish-FRC)
W83-02786

6F. Nonstructural Alternatives

THE ECONOMIC EFFICIENCY OF FLOOD PLAIN DEVELOPMENT,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
W. M. Park, and W. L. Miller.
Water Resources Research Center Technical Report No 141, Purdue University, West Lafayette, Indiana, May 1982. 84 p, 7 Fig, 52 Ref.

Descriptors: *Flood plain management, *Flood plain zoning, *Flood insurance, *Economic aspects, Flood plains, Risks, Insurance, *Indiana, Logansport.

This study examines resource allocation in the flood plain. The objectives included the development of a theoretical framework and the use of an empirical case study to explore the extent of overallocation of resources in flood prone areas and to access alternative policies to correct this problem. Economic theory indicates that efficiency will be achieved when all land parcels in the flood plain are allocated to their most productive uses and capital investment is carried to the optional level. When no public management of flood plain development exists, over-investment is likely to occur. When an insurance program is introduced in the form of actuarially premiums reflecting the expected average flood damage on each parcel of land, the market will allocate land to its most productive use and guide capital investment decision to the optimal level. A simple zoning approach would eliminate welfare losses due to overdevelopment in the flood plain, but it might prohibit some socially rational investments. Analysis of the impact of the Federal Flood Insurance Program in Logansport, Indiana, indicates residential property values in the flood plain were less than fully discounted for the existing flooding potential prior to introduction of the program. Overdevelopment had occurred and therefore, social welfare losses were being occurred. This implies there are benefits to be gained from more efficient allocation of resources in the flood plains.
W83-02477

6G. Ecologic Impact Of Water Development

LAND-USE AND MANAGEMENT PROBLEMS IN THE NILE DELTA,
Ministry of Irrigation, Cairo (Egypt). Research Inst. for Groundwater.
K. Hefny.
Nature and Resources, Vol 18, No 2, p 22-27, April/June, 1982. 4 Fig, 1 Tab.

Descriptors: *Environmental effects, *Coastal zone management, *Sedimentation, *Deltas, *Nile River Delta, Irrigation, Rivers, Sediment transport, Geomorphology, Ecological effects, Aquatic plants, Drainage, Aswam Dam, *Egypt.

The Nile River delta and its ecosystem have been affected by water control projects and urban development, especially within the last 100 years. The Aswan High Dam, constructed during the 1960's, has reduced the silt load to 1.5-4% of that formerly carried by the river. Unless a new equilibrium is reached, the delta will gradually recede. The estuarine ecosystem has been altered drastically by changes in the salinity regime and nutrient levels. Basin irrigation has given way to perennial irrigation, but drip or sprinkler irrigation could save an additional 30-50% of the water. Water hyacinth and other aquatic plants, which have flourished in the irrigation canals, influence biotic relationships, both positively (food sources) and negatively (disease-carriers). The large groundwater reservoir underlying the delta is of great economic importance, but present knowledge is insufficient for proper management. Several strips of the seacoast several kilometers wide have been removed by the sea during the last 200 years. The erosion process, especially in the softer western and eastern parts of the delta, is expected to increase with the reduction of sediment deposition. Research and monitoring of the river and delta must be interdisciplinary to provide reliable information for managing water resources and protecting the coastline. (Cassar-FRC)
W83-02462

PREDICTION OF EFFECTS OF DAILY FLOW FLUCTUATIONS ON STREAM BIOTA,
Michigan Univ., Ann Arbor. School of Natural Resources.
F. F. Hooper, and D. R. Ottey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-190454, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State Univ., East Lansing, December 1982. 46 p, 4 Fig, 12 Tab, 76 Ref. OWRT A-113-MICH(1), 14-34-0001-1124.

Descriptors: *In-stream flow, *Benthos, *Caddisflies, *Mayflies, Micro-distribution, Floods, Regulated flows, *Michigan, Streams, Trout, Species diversity, Hydroelectric power.

The short-term effects of regulated daily discharges on benthos communities were examined in a small Michigan trout stream. Flow regulation designs simulated fluctuations produced by storage and release for hydroelectric generation, as well as different constant daily stream diversions. Impacts on the dynamics of micro-distribution, species diversity, and behavior were evaluated on stable artificial substrates. Invertebrate drift rates were measured at different discharges during light and dark periods. The caddisfly G. nigrior became less active and oriented downstream when exposed to high discharge, and underwent movements to protected substrate faces. On exposed surfaces, low daytime discharge resulted in accentuation of the control pattern of micro-distribution changes, while high discharge during days produced the inverse diel pattern. The mayfly Baetis vagans also changed micro-positioning in response to flow fluctuations, but total density changes generally were more pronounced. Light period drift rates were low and weakly related to discharge for many species, while dark period drift was more strongly influenced by flow. Low to high discharge fluctuation impacts on densities were comparable to losses during a minor natural flood, and species most susceptible to flood impacts suffered greatest estimated losses following fluctuations to high flows. There was evidence for increased species diversity during low discharges.
W83-02480

THE CREST DISPUTE: A MEDIATION SUCCESS,
Institute for Environmental Mediation, Seattle, WA.
For primary bibliographic entry see Field 6D.
W83-02532

EFFECTS OF IMPOUNDMENT OF DESAULNIERS RESERVOIR (JAMES BAY TERRITORY) ON ZOOPLANKTON IN A RIVER AND A STRING BOG. (EFFETS DE LA MISE EN EAU DU RESERVOIR DESAULNIERS (TERRITOIRE DE LA BAIE DE JAMES) SUR LE ZOOPLANCTON D'UNE RIVIERE ET D'UNE TOURBIERE RETICULEE),
Montreal Univ. (Quebec). Dept. of Biological Sciences.
B. Pinel-Alloul, E. Magnin, and G. Codin-Blumer.
Hydrobiologia, Vol 86, No 3, p 271-296, 1982. 12 Fig, 6 Tab, 52 Ref.

Descriptors: *Zooplankton, *Population dynamics, *Reservoirs, Cladocera, Biomass, Rotifera, Copepods, Bogs, Ecological effects, Rivers, Desaulniers River, James Bay territory, Reservoir stages, Canada.

Results are presented of a three year study on the effects of impounding a river on the zooplankton communities in that river. Forty zooplankton samples were collected from the Desaulniers River and from a string bog in 1976 before impoundment. Sampling was also conducted in 1977 (331 samples) and 1978 (153 samples) during and after impoundment. The population dynamics of zooplankton show different patterns in 1977 and 1978. The main impacts of impoundment on the river and the bog communities were increases in the number of species of Rotifera and the increase of the diversity indices based on numbers and biomass. These changes are observed at each sampling station. The total biomass increases in lotic stations but decreases in the string bog because the density and the biomass of Cladocera increased in the river but dropped in the bog. Results are compared to those obtained in natural lakes and bogs of the same area and to those published in other studies. (Baker-FRC)
W83-02604

INTERACTION OF LARGE HYDRAULIC ENGINEERING SYSTEMS WITH THE ENVIRONMENT,
S. L. Vendrov.
Hydrotechnical Construction, No 2, p 175-181, February, 1980. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 2, p 40-44, February, 1980.

Descriptors: *Water resources development, *Environmental effects, *Hydroelectric plants, Reservoirs, Economic development, Hydraulic engineering, Water management, Planning, Forecasting, *USSR.

The history and present status of environmental protection during water resources development projects in the USSR are discussed. Present Policies are based on party directives, the USSR constitution, and the constitution of union republics. Decisions affecting the environment are made throughout an entire project, from predesign through final construction. In several projects design plans were revised or projects dropped as changes in the natural and economic setting and goals for conservation changed. In general, the higher the level of development and installed power per worker, the more stringent the environmental protection requirements. As development increases, environment protection becomes increasingly important. No land is so unimportant that it can be turned into a wasteland. There are territorial differences in policy, such as use of pipelines and underground structures rather than open channels for water transport in heavily populated and industrialized regions. The preliminary forecast of environmental impact uses file and literature sources and takes about a year in the predesign stage. The main forecast involves field, laboratory, mathematical, modeling, and theoretical investigations over several years. These findings are successively refined as necessary. It is emphasized that forecasts must be individualized to the project. A forecast should include viewpoints of a variety of specialists and organizations, the effects of a project (such as interbasin transfer) on all the geographic zones, substantiation that adverse effects will not be irreversible, and unconditional provision of medical-sanitary aspects of water. (Cassar-FRC)
W83-02606

ECOLOGICAL FOUNDATIONS OF MEASURES TO PROTECT THE HYDROSPHERE AGAINST MAN-MADE POLLUTION,

Institute of Biology of the Southern Seas, Sevastopol (USSR).
G. G. Polikarpov.
Hydrobiological Journal, Vol 17, No 6, p 1-8, 1981. 4 Fig, 23 Ref.

Descriptors: *Environmental effects, Water pollution effects, Pollutant identification, Monitoring, Model studies, Forecasting, Air pollution.

The ecological study of the measures for protection of the hydrosphere against man-made pollution consists of the following essential elements: analysis of aspects of man-induced contamination and alteration of the environment to achieve an understanding of the effect of such alterations on the ecology of salt- and freshwater environments; analysis of mechanisms of direct and indirect effect of combinations of man-made pollutants on aquatic ecosystems; the development of models and forecasts of ecological changes in seas, lakes, and streams as a result of human activity; ecological monitoring of the state and changes in hydrospheric zones under stress of man-made pollutants; and a description of specific ecological responses in particular regions and under specific man-made pollution conditions, with development of recommendations and measures for decreasing that pollution in aquatic ecosystems. Each of these subjects falls under one of three general headings: overall problems, including the concept of capacity of environments to deal with contaminants; central problems of ecological monitoring; and the principles of science of freshwater protection from contaminants. (Baker-FRC)
W83-02626

ENVIRONMENTAL CONSIDERATIONS OF THE DRAKENSBERG PUMPED STORAGE SCHEME,
Department of Water Affairs, Forestry and Environmental Conservation, Pretoria (South Africa).
C. P. R. Roberts, and J. J. Erasmus.
Civil Engineer in South Africa, Vol 24, No 8, p 361-363, 365, 368-371, 373, 455, August, 1982. 19 Fig, 11 Ref.

Descriptors: *Pumped storage, *Environmental engineering, Drakensberg Pumped Storage Scheme, *South Africa, Reservoirs, Landscaping, Construction, Aesthetics, Vegetation, Dam construction, Kilburn Dam, Earth dams.

Planning of the Drakensberg, South Africa, pumped storage scheme involved environmental considerations from the earliest stages. A committee representing public and private sectors prepared an environmental impact assessment for the construction area, a place of natural scenic beauty. Recommendations for minimizing environmental damage included afforestation of acquired farmland, construction of temporary roads on the routes of permanent roads and in designated locations, preservation of indigenous vegetation, replanting with only indigenous species, location of borrow areas and spoil material in regions to be submerged, construction of power lines and towers in non-straight lines and in inconspicuous colors, a visitor's center, excavation of fossil or archeological sites prior to destruction, and consideration of aesthetics in landscape and building design. (Cassar-FRC)
W83-02664

COME HELL AND HIGH WATER: MT. ST. HELENS AND THE FEDERAL RESPONSE ON THE LOWER COWLITZ RIVER,
Central Washington Univ., Ellensburg. Dept. of History.
For primary bibliographic entry see Field 4A.
W83-02724

EVALUATING THE INFLUENCE OF GEOCHEMICAL ORIGIN AND DROUGHT ON AQUATIC BIOTA OF THE KNOWN GEOTHERMAL RESOURCE AREA (KGRA) OF CALIFORNIA,
California Univ., Berkeley. Div. of Entomology and Parasitology.
V. H. Resh, G. A. Lamberti, E. P. McElravy, and J. R. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-191809, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, California Water Resources Center, Univ. of California, Davis, March 1983. 124 p, 10 Fig, 9 Tab, 62 Ref. OWRT B-200-CAL(1).

Descriptors: *Geothermal studies, *Biological sampling, Sampling, *Data Collections, Aquatic life, Benthic environment, Benthos, *California, *The Geysers KGRA, Biota, Energy development, Drought.

From 1976-1983, a series of studies was undertaken at the Geysers KGRA in Sonoma and Lake Counties, California to evaluate the effects of geothermal energy development on aquatic biota at The Geysers. A major objective throughout the eight years of the research project has been to develop quantitative methods to analyze and monitor benthic communities. This report summarizes the methods used and presents examples of the data such approaches have produced. Each report on a sampling approach contains: (1) a summary of the advantages and disadvantages of the device; (2) an illustration of the device; (3) a description of its use either at The Geysers or in pilot studies to test the appropriateness of its use at The Geysers; and (4) a sample data set. (Snyder-California)
W83-02725

VALUATION OF INTANGIBLES: THE CASE OF WATER QUALITY,
Massachusetts Univ., Amherst. Dept. of Agricultural and Resource Economics.
For primary bibliographic entry see Field 6B.
W83-02732

THE SEPARATION OF THERMAL AND CHEMICAL EFFECTS IN EVALUATING GEOTHERMAL INFLUENCES ON AQUATIC BIOTA,
California Univ., Berkeley. Div. of Entomology and Parasitology.
For primary bibliographic entry see Field 5C.
W83-02738

HYDROELECTRIC POWER UTILIZATION AND ENVIRONMENTAL PROTECTION (WASSERKRAFTNUTZUNG UND UMWELTSCHUTZ),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
D. Vischer.
Wasser, Energie, Luft, Vol 74, No 3, p 33-40, March, 1982. 12 Fig, 14 Ref. English summary.

Descriptors: *Hydroelectric power, *Environmental effects, *Ecosystems, *Hydrologic systems, *Human population, Climates, Geology, Economic aspects, *Switzerland, Reservoirs, Animal populations, Wildlife habitats, Plant populations, Water resources development, Safety.

The environmental impacts of hydroelectric power plants in alpine and prealpine regions are reviewed, focusing on specific Swiss examples. Impacts on physical systems include influences on the water cycle, on the atmosphere, and on the crust of the earth. The quantity of surface waters is influenced differently by plants with dams and those using running water, and underwater quantity is impacted by reservoir construction. Reservoirs act as settling basins for sediments and suspended solids, thereby influencing water quality. Heat stored in reservoirs and the associated evaporation can cause climatic changes, though these are minor in alpine regions. The saturation of valley sides flooded by reservoirs can reduce their stability, resulting in landslides or even minor earthquakes (as occurred at the Contra reservoir near Locarno). Impacts on biological systems involve the terrestrial and aquatic systems. While new reservoir construction annihilates animals and plants, reservoirs with level banks and constant water levels sometimes foster a rich vegetation (those with fluctuating water levels often form a desert-like strip along their banks). The initial filling of a reservoir results in a rapid enrichment of the water with nutrients, impacting on the food chain of the reservoir's population. In reservoirs too high above sealevel for a rich animal and plant life or in which the land was cleared before flooding, pollutants in the inflowing water exert a larger influence, and the reservoirs act as sand filters and purification basins. (Gish-FRC)
W83-02788

7. RESOURCES DATA

7A. Network Design

REMOTE SENSING DETERMINATION OF HYDROGRAPH RECESSION CHARACTERISTICS,
Idaho Univ., Moscow. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W83-02487

7B. Data Acquisition

A MICROPROCESSOR BASED WATER LEVEL RECORDER AND SAMPLER CONTROLLER,
Anne Arundel County Dept. of Public Works, Glen Burnie, MD. Utility Bureau.
R. L. Kort, A. T. Johnson, J. E. Ayars, and A. D. Schlosser.
Transactions of the ASAE, Vol 25, No 5, p 1282-1283, 1289, September/October, 1982. 2 Fig, 2 Ref.

Descriptors: *Data acquisition, *Data storage and retrieval, *Samplers, Water level, Water sampling, Microprocessors, Computers.

Acquisition and analysis of hydrologic data using current techniques is a time consuming and expensive process which demands better data collection and reduction procedures. Very low power consumption levels, wide operating temperature range, and good noise immunity make the 12-bit CMOS microprocessor ideal for portable, self-contained instrumentation. The collection unit is comprised of a microcomputer including non-volatile memory boards, support hardware, a shaft angle encoder, a float operated level sensor, a cabinet to house the electronics, and a base to hold the cabinet and encoder. The data transfer unit consists of a second Intercept Jr. Microcomputer, non-volatile memory boards, a serial Input/Output module, a terminal, and a telephone modem computer link. (Baker-FRC)
W83-02457

AUTOMATIC TENSIOMETER SCANNER FOR RAPID MEASUREMENTS,
Florida Univ., Gainesville. Dept. of Agricultural Engineering.
A. B. Bottcher, and L. W. Miller.
Transactions of the ASAE, Vol 25, No 5, p 1338-1342, September/October, 1982. 6 Fig, 12 Ref.

Descriptors: *Tensiometers, *Measuring instruments, *Electronic equipment, *Soil moisture, Moisture availability, Soil water, Irrigation practices.

An automatic tensiometer scanning device was designed and constructed to read and record eighty individual tensiometers at a maximum frequency of once a minute. Scanning photocells were used to detect mercury levels in manometer-type tensiometers. The drive mechanism, photocells, and light sources are controlled or sensed by a battery powered microprocessor through an interface box. The data are stored on a magnetic tape and/or printed on paper. Accuracy is limited by the response time of the tensiometer itself, but differences in the mercury level can be detected to within 0.08 cm of mercury. Reliability of the prototype scanners has been excellent. The cost per tensiometer read for the described system can be lower than for other currently available multi-tensiometer rapid measurement systems. (Baker-FRC)
W83-02458

MEASUREMENT AND MODELING OF MICROWAVE EMISSION FROM FORESTED SNOWFIELDS IN MICHIGAN,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2C.
W83-02774

7C. Evaluation, Processing and Publication

QUANTIFYING SOURCE AREAS THROUGH LAND SURFACE CURVATURE AND SHAPE,
Massey Univ., Palmerston North (New Zealand). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W83-02702

WEEKLY WATER USE ESTIMATES BY CROPS AND NATURAL VEGETATION IN INDIANA,
Purdue Univ., Lafayette, IN. Agricultural Experiment Station.
For primary bibliographic entry see Field 2D.
W83-02739

DETECTION OF RAINFALL RATES UTILIZING SPACEBORNE MICROWAVE RADIOMETERS,
Environmental Research and Technology, Inc., Concord, MA.
For primary bibliographic entry see Field 2B.
W83-02798

8. ENGINEERING WORKS

8A. Structures

HYDRO-FRACTURING AT HELMS,
Pacific Gas and Electric Co., San Francisco, CA.
A. G. Strassburger.
International Water Power and Dam Construction, Vol 34, No 10, p 25-28, October, 1982. 2 Fig, 4 Ref.

Descriptors: *Hydroelectric plants, *Pumped storage, *Rock excavation, Hydraulic machinery, Pump turbines, Turbines, Construction, Helms Project, *California, Underground powerplants, Tunnels, Conduits, Hydrofracturing, Pacific Gas and Electric Company, Powerplants, Tunnel linings, Linings.

Several unusual features were incorporated into the Helms project (Pacific Gas and Electric Company of San Francisco), located in the Central Sierra Nevada Mountains 85 km northeast of Fresno. Topographic, geologic, environmental, and esthetic considerations dictated the alignment of conduits and the locations of other equipment, mostly underground. Surrounding rock and the reinforced concrete tunnel lining will be deliberately hydro-fractured by the hydrostatic loads, which will be excessive because of long water conduits, deep powerhouse submergence, need for 2 surge tanks, and a desire for rapid load response and turnaround. A conservatively designed drainage system will protect the other underground facilities from high hydrostatic pressures. For environmental reasons no access road was built at the top of the surge shaft and workers were not housed on site. The penstock shaft, inclined at 55 degrees, proved far more difficult to construct than anticipated. Concrete was delivered at extremely high heads by pipe placing methods. A unique feature of the generator-motors is the cooling system. A conventional air ventilation system cools all components but the stator coils, which are cooled by very pure water. Construction delays were caused by extremely adverse winter weather, geological conditions, and the remoteness of the site. (Cassar-FRC)
W83-02539

THE DESIGN OF DRAKENSBERG,
Electricity Supply Commission, Johannesburg (South Africa).
W. Z. Pyzikowski.
International Water Power and Dam Construction, Vol 34, No 10, p 33-36, October, 1982. 2 Fig, 2 Tab.

Descriptors: *Hydroelectric plants, *Pumped storage, *Reservoir operation, Reservoirs, Interbasin transfers, Water transfer, Powerplants, Drakensberg Plant, *South Africa, Driekloof Reservoir, Kilburn Reservoir, Sterkfontein Reservoir, Tunnels, Conduits, Underground powerplants.

The Drakensburg hydroelectric plant in South Africa operates two reservoirs, Driekloof and Kilburn, 4 km apart and with 446 m difference in head. It functions as a pumped storage plant and in the interbasin transfer of water between the Tugela and Vaal River basins. A unique feature is the creation of Driekloof Reservoir within a cove of the larger Sterkfontein Reservoir. The Driekloof dam spillway, which is submerged for 12% of the time, provides water for operating the scheme on a weekly cycle when the larger reservoir level is too low. The lower Kilburn dam operates on a weekly cycle with a load factor of 30% in the generating mode. An underground waterway system consists of tunnels, shafts, and penstocks, which are described in detail. There are three main underground caverns: machine hall, valve hall, and transformer hall. (Cassar-FRC)
W83-02541

CZECHOSLOVAKIA'S LARGEST PUMPED-STORAGE PLANT,
Hydroconsult, Bratislava (Czechoslovakia).
J. Motlik.
International Water Power and Dam Construction, Vol 34, No 10, p 36-39, October, 1982. 5 Fig, 3 Ref.

Descriptors: *Pumped storage, *Hydroelectric plants, Cierny Vah, *Czechoslovakia, Reservoir operation, Powerplants, Tunnels, Dam construction, Seepage control, Turbines, Pump turbines, Hydraulic machinery, Penstocks.

The Cierny Vah pumped storage plant, scheduled for completion in 1983, is the largest of its type in Czechoslovakia. It has the capacity to produce 1285 GWh per year. Main components are the lower reservoir with a mean annual inflow of 4.25 cu m per sec, the upper reservoir with no natural inflow, penstocks, and surface powerplant. Both reservoirs have a 3.7 million cu m storage capacity. A particular problem was the permeability of the clay-contaminated local dolomites and limestones. The upstream face of the upper reservoir was sealed with asphalt, and a system was created for seepage monitoring. At the dam foundation, hollows were discovered beneath the design foundation level; these had to be filled before sealing. Installed capacity of the powerhouse is 665 MW. Daily generation lasts for 5.53 hours, and pumps are operated for 8 hours, On a yearly basis turbines are used for 2018 hours and pumps for 2920 hours. Turbine and pump rates of flow are 30 and 22 cu m per sec, respectively for each of the 6 units. (Cassar-FRC)
W83-02542

BUILDING A HYDRO STATION IN A NARROW GORGE,
I. G. K. Soos.
International Water Power and Dam Construction, Vol 34, No 6, p 20-26, June, 1982. 14 Fig, 1 Tab.

Descriptors: *Design criteria, *Dam construction, *Dam design, *Hydroelectric power, *Brazil, *Canyons, Construction costs, Dam foundations, Reservoirs, Electric power production, Electrical equipment, Hydraulic turbines, Sao Francisco River.

The unusual design and construction problems of the Xingo hydroelectric development on the Sao Francisco River in northeast Brazil are described. The dam is to be built in a narrow gorge with an average slope of 120 degrees. The high river flow of 2060 cu m/sec means that filling, if uncontrolled, would take 11.5 days. The reservoir is expected to have little ecological impact and negligible siltation. The river bed itself will serve as a plunge-pool, and the filling of the reservoir will have to be controlled with large capacity outlets. An exploration shaft will determine the performance of the foundation rock, gorge sediments and fault zone. A building will be erected with an overhead travelling crane and railways and aerial cableways for placing prefabricated elements in the gorge. Construction will be carried out without diversions or cofferdams. When a three-stage river closing is complete, the reservoir will be filled and plans for operation of the ten 400 MW generators will commence. Each generator is coupled to 545 b.h.p. Francis turbines. The elimination of diversion tunnels and cofferdams will save construction time and cut costs. (Geiger-FRC)
W83-02543

SURGE CHAMBER DESIGN FOR JUKLA,
Geoteam A/S, Oslo (Norway).
For primary bibliographic entry see Field 8E.
W83-02572

OVERFLOW ROAD CROSSING ACROSS THE DNESTR RIVER AT THE CONSTRUCTION SITE OF THE DNESTR HYDROSTATION,
B. D. Shmul'son.
Hydrotechnical Construction, No 11, p 1115-1119, November, 1980. 3 Fig, 2 Ref. Translated from Gidroteknicheskoe Stroitel'stvo, No 11, p 9-12, November, 1980.

Descriptors: *Bridges, *Construction, *Overflow, Hydroelectric plants, Dnestr River, *USSR, Dam construction, Floods.

An overflow bridge was constructed across the Dnestr River, USSR, to provide passage for construction vehicles during building of the hydrostation there. The low-cost crossing was constructed in conjunction with the cofferdams over a period of several months. The crossing consists of 5 reinforced concrete pipes (cross section 5.5 x 6.0 m) and a rock embankment damming the river channel. The crest of the embankment serves as the roadway. After completion in November 1977, the bridge survived several floods, many containing large ice floes. There were eight overflow floods in 1978 and three severe winter floods with large amounts of ice in 1979. Damage to the bridge was not significant. Adjustments to the design prevented further undesirable erosion. (Cassar-FRC)
W83-02594

MULTISTAGE WHIRLPOOL SHAFT SPILLWAYS,
S. M. Slisskii, E. B. Kuznetsov, and T. Kh. Akhmedov.
Hydrotechnical Construction, No 9, p 892-895, September, 1980. 3 Fig, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 9, 10-12, September, 1980.

Descriptors: *Spillways, *Tunnels, *Flow pattern, Reservoirs, Conduits, Water flow, Spiral spillway, Tangential spillway, Design criteria, Dam design, *USSR, Meodeo Dam.

A design ensuring impactless entry of flow from horizontal or inclined tunnels into a shaft was investigated. The tangential feed arrangement (tunnel connected to the shaft so that the external tunnel wall is tangent to the shaft wall) was tried at the Medeo mudflow protection dam in the USSR. A scale model was used to verify the tangential design and to investigate a spillway alternative with a spiral chamber. Discharge capacity, length of the stretch in which rotational motion is maintained, and the angle of twist of the flow in the initial section were almost equal for tangential feed and spiral chambers. (Cassar-FRC)
W83-02597

INSTRUMENTING AUSTRALIA'S CETHANA DAM,
Tasmania Hydro-Electric Commission, Hobart (Australia).
M. D. Fitzpatrick, and R. H. W. Barnett.

International Water Power and Dam Construction, Vol 34, No 11, p 26-30, 1982. 7 Fig, 1 Tab, 3 Ref.

Descriptors: *Dam construction, *Dam stability, *Dam foundations, *Monitoring, *Concrete dams, *Rock mechanics, *Stress, *Deflection, Deformation, Pressure measuring instruments, Dam design, Rockfill dams, Leakage, Strain, Dams, Measuring instruments, Cethana dam, *Australia.

A monitoring system was installed at the concrete-faced Cethana dam in Australia to provide measurement of vertical settlement within the embankment, deflection at crest level and on the downstream face, deflection in the vertical and slope directions, and normal deflection of the membrane and the plinth, strain and temperature in the membrane, no-stress strain and temperature in the concrete blocks resting on the membrane, and leakage at the downstream toe. The general arrangement of the system is diagrammed, and specific aspects of the monitoring scheme such as settlement cells, crest targets, downstream face targets, anchored membrane deflection wires, installation of inclinometers, perimetric joint meters, and leakage weirs are described. Since the dam was performed satisfactorily for eleven years, monitoring of dam functions will be reduced to five yearly intervals. Between 1973 and 1980, settlement and deflection rates were stabilized at about 4 and 3 mm per year, respectively. Increased deflection close to the crest is attributed to reduced confinement near the downstream face. Settlement measurement have been affected by flushing of organic matter from the hydrostatic cells. No real changes in joint movements have occurred since the first year. Strain and stress measurements combined with creep response and inclinometer and survey data indicate overall structural stability. Leakage has remained at 10 liters/sec for the past 6 years. As a result of experience with the Cethana dam monitoring system, the Hydro-Electric Commission of Tasmania has been able to improve features of the downstream face targets, anchored face wires, perimetric joint measurements, inclinometer pipes and strain meters for future dam monitoring systems. Several other dams have benefited from dam monitoring knowledge gained at Cethana dam. (Geiger-FRC)
W83-02603

LONG-TERM MONITORING OF EMBANKMENT DAMS IN BRITAIN,
For primary bibliographic entry see Field 8D.
W83-02628

THE CONSTRUCTION OF THE TUGELA-VAAL PROJECT DAMS,
Davies and Loubser Ltd. (South Africa).
A. G. Davies.
Civil Engineer in South Africa, Vol 24, No 8, p 385-387, 389, August, 1982. 5 Fig, 3 Ref.

Descriptors: *Dam construction, *Pumped storage, Reservoirs, Construction, Woodstock Dam, Sterkfontein Dam, Driekloof, Kilburn Dam, Tugela River, Vaal River, Earth dams, Rockfill dams, Spillways, Drakensberg Pumped Storage Scheme, *South Africa.

Construction of the Tugela-Vaal project dams, part of the Drakensberg Pumped Storage Scheme in South Africa, is described. Woodstock, 49 m high, was constructed within 1 year with materials borrowed from the basin. The impervious core is well-decomposed dolerite. Curtain grouting was difficult. Kilburn Dam, 51 m high, is in an environmentally sensitve section. Driekloof Dam, subject to continued cycles of very rapid drawdown and filling, was made of soft sandstone. Sterkfontein Dam has a small catchment relative to the basin size, so no spillway was constructed. During the second stage, this dam is being raised from the first stage of 69 m to 93 m. (Cassar-FRC)
W83-02643

THE DAMS OF THE TUGELA-VAAL PROJECT,
Department of Water Affairs, Forestry and Environmental Conservation, Pretoria (South Africa).
H. F. W. K. Elges.
Civil Engineering in South Africa, Vol 24, No 8, p 375-377, 379-381, 383-384, August, 1982. 12 Fig, 13 Ref.

Descriptors: *Pumped storage, *Dam construction, Drakensberg Pumped Storage Scheme, *South Africa, Reservoirs, Construction, Tugela River, Vaal River, Earth dams, Spillways, Kilburn Dam, Driekloof Dam, Sterkfontein Dam, Woodstock Dam.

Some interesting engineering features of the four-dam Drakensburg Pumped Storage Scheme, South Africa, are described. The Driekloof Dam, located within the Sterkfontein Basin, was built with soft sandstone fill. A baffled apron spillway was placed centrally over the embankment. The Kilburn Dam was built with material from the dam basin; the upstream dam face is rather flat. The Woodstock Dam was also constructed with local materials and a flat upstream slope. Its spillway is an uncontrolled curved ogee overflow, chute, and energy dissipator. The Sterkfontein Dam, largest in South Africa when finished, was made of local stones of varying composition, giving rise to a rather flat upstream slope. (Cassar-FRC)
W83-02648

BOUNDARY METHODS IN WATER RESOURCES,
Universidad Nacional Autonoma de Mexico, Mexico City. Inst. de Investigacion en Matematicas Aplicadas y en Sistemas.
I. Herrera.
Advances in Water Resources, Vol 5, No 3, p 130-135, September, 1982. 2 Fig, 33 Ref.

Descriptors: Water resources, *Boundary methods, Mathematical equations, *Boundary conditions.

A brief review of boundary methods is presented, placing emphasis on alternatives to boundary integral equations. Different theoretical questions required to give a firm foundation to these procedures are discussed, and extensions to non-linear problems are explained. Examples of application to fluid problems are included. An abstract framework which can be used to make the subject more systematic is briefly described. This can be interpreted in terms of Green's formula and presented in a form which is suitable for application to formally symmetric operators, although it has recently been extended to general non-symmetric operators. One of the applications of this framework is the formulation of variational principles. Problems formulated in discontinuous fields with prescribed jump conditions such as those that were surveyed by Nemat-Nasser constitute a general application of the theory. Another example is problems which are subjected to continuation type restrictions, that is, problems formulated in a region subjected to the restriction that the solutions can be continued smoothly into solutions of given differential equations in a neighboring region. (Baker-FRC)
W83-02655

CONSTRUCTION OF THE MAIN CIVIL WORKS OF THE DRAKENSBERG PUMPED STORAGE SCHEME,
P. A. C. Hallier, P. B. Weehuizen, and G. W. Holl.
Civil Engineer in South Africa, Vol 24, No 8, p 421, 423-425, 427-429, 431-433, August, 1982. 12 Fig, 2 Tab, 6 Ref.

Descriptors: *Rock excavation, *Underground structures, *Tunnels, Civil engineering, Drakensberg Pumped Storage Scheme, *South Africa, Excavation, Powerplants, Construction, Pumped storage, Concrete technology, Grouting.

Civil works for the Drakensberg Pumped Storage Scheme, South Africa, involved excavation of 510,000 cu m of rock and installation of concrete, steel, and rock bolts. This phase of the project, lasting from 1977 to 1981, required excavation, support, lining, and grouting large excavations in rock formations of poorly cohesive nature. The presence of thin layers of carboniferous materials required application of Fiery Mines regulations. Types of work were circular shafts (1.83-3 m for ventilation and 19 m for downstream surge chambers), surge/pressure shafts, smaller shafts, tunnels (3 x 3 m to 7.75 x 8.5 m), halls (machine, transformer, and valve) and grouting. For each type of construction, the methods, breaking, mucking, and lining and support are described. Grouting was especially complicate and exacting. Use of the interface or pre-stress grouting method was unique in this country. (Cassar-FRC)
W83-02665

THE STERKFONTEIN DAM OUTLET WORKS,
A. W. Sykes, and W. C. S. Legge.
Civil Engineer in South Africa, Vol 24, No 8, p 391-393, 398, August, 1982. 4 Fig, 7 Ref.

Descriptors: *Outlets, *Stilling basins, Dam construction, Sterkfontein Dam, Drackensberg Pumped Storage Scheme, Tunnels, Construction, Pumped storage, Cavitation, Hydraulic gates, Gates, *South Africa.

The outlet works of the Sterkfontein Dam (Drakensberg Pumped Storage Scheme, South Africa) include a pair of leaf or slab gates 1.5 m x 4 m, one of the largest of their type in the world. A 430 m long pressure tunnel leads to the gates, directly under the dam crest. Small discharges are handled by a 600 m gate valve which bypasses the main gates to prevent cavitation erosion. Downstream of the gates, the flow is free at velocities up to 30 m per sec. The tunnel ends in a transition zone and stilling basin, which discharges into a 30 m wide riprap-lined canal. A model was built to study performance of the design. It showed that the stilling basin needed certain modifications--a hump on the transition zone floor, guide vanes to divert more flow to the sides, a round step (radius = height) at the drop, and a wave suppressor at the basin entrance. (Cassar-FRC)
W83-02666

THE DRAKENSBERG PUMPED STORAGE SCHEME DESCRIPTION OF SCHEME AND PRINCIPAL DATA,
Electricity Supply Commission, Johannesburg (South Africa).
W. Z. Pyzikowski.
Civil Engineer in South Africa, Vol 24, No 8, p 353-356-357, 359, August, 1982. 3 Fig, 2 Tab.

Descriptors: *Hydroelectric powerplants, *Design criteria, *Pumped storage, Reservoirs, Planning, Interbasin transfers, Decision making, Management, Dams, Water supply, *South Africa, Drakensberg Project.

The Drakensberg Pumped Storage Scheme is described as a whole, including its functions, main features of the upper and lower reservoirs, the geometry and dimensions of the waterways, arrangement of underground caverns as well as the principal hydro-mechanical data of the scheme. Certain aspects of the philosophy of the design of the scheme are also included. The scheme was designed to operate as a pumped storage facility capable of generating normally 1,000 MW during the peak demand hours and up to 1,080 MW under high head conditions, and utilizing relatively cheap surplus power available during the off-peak periods for pumping. The scheme was also to effect the inter-catchment transfer of water between the Tugela River basin and the Vaal River basin. The most unusual feature of the scheme is the very large volume of the upper and lower reservoirs, which can support operation of the scheme, in generating mode, with a weekly load factor of up to 30%. This means that during the scheme's weekly operating cycle the full output of 1,000 MW can be generated for up to 10 hours per day during the five working days, Monday-Friday. Very few pumped storage schemes in the world generate longer than two to three hours daily without pumping and many of them have been designed to generate for less than one hour at a time. (Baker-FRC)
W83-02671

TECHNOLOGY--WHAT IS IT FOR. TWO EXAMPLES FROM THE MORE THAN 2,000-YEAR HISTORY OF HYDRAULIC ENGINEER-

ING IN CHINA (TECHNIK WOZU. ZWEI BEISPIELE AUS DER UBER 2000JAHRIGEN GESCHICHTE DES WASSERBAUES IN CHINA),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Wasserwirtschaft.
T. Dracos.
Wasser, Energie, Luft, Vol 73, No 1/2, p 11-14, January/February, 1981. 7 Fig, 5 Ref. English Summary.

Descriptors: *Hydraulic engineering, Dams, *Irrigation, *Flood control, *Hydroelectric plants, *China, Earth dams, Gravity dams, Overflow channels, Yellow River, Minjian River, Reservoirs, Silting, River basin development, Flood protection, History.

The question 'Technology: what is it for, where is it going' is answered using the examples of two Chinese water projects, the Dujiangyan irrigation project and the multipurpose facility at Sanmenxia. The Dujiangyan project was constructed from 256 to 252 B.C., while the Sanmenxia plant was built during the 1950s and '60s A.D. The irrigation project, which is still serving its original purpose successfully (after expansion, it irrigates 570,000 hectares), consists of three parts: an earth dam that separates the Minjian river into inner and outer channels; an approximately 20-m-wide entrance, cut into the rock of the river bank, to the irrigation network; and an overflow channel. The 'outer' channel, which is actually situated on the inner part of a channel, flowing parallel on the other side of the dam, directs water into the irrigation ditches. Superflous water from the inner channel is returned to the river below the dam. The project also screens out most of the rocks and debris carried by the river from the irrigation network. The Sanmenxia plant (for flood control, irrigation, and energy production) is situated at the lower end of the midsection of the Yellow River and consists of a 702-m-long gravity masonry dam and a 206-m-long earth dam. It was designed to solve the problems of the river (1,500 dam breaks in the last 2,000 yr and 9 changes in the course of the lower river). The filling of the reservoir began in 1960. By 1964, the reservoir was already so heavily silted that the danger of upstream flooding was extremely high, so that construction changes had to be instituted. The limits of technology today must be recognized. (Gish-FRC)
W83-02760

CUBELLES THERMAL POWER PLANT-A NEW SOLUTION FOR THE INTAKE AND DISCHARGE OF COOLING WATER (CENTRA TERMICA DE CUBELLES-UNA NUEVA SOLUCION PARA LA TOMA Y DESCARGA DE AGUA DE REFRIGERACION),
Madrid Univ. (Spain).
P. S. Bores.
Progress in Water Technology, Vol 12, No 1, p 419-426, 1980. 5 Fig, 1 Tab, 5 Ref. English summary.

Descriptors: *Intakes, *Powerplants, *Construction, *Cooling water, Coastal waters, Recreation, Sand traps, Marina, Boating, Esthetics, Waves.

By converting a primary sand trap into a beach and a secondary sand trap into a marina, the intake for a million kilowatt fuel power plant in shallow waters off the Catalonian coast was transformed into a multi-purpose complex. The complete breakwater system is longer than a mile. In efforts to preserve the sea panorama, the crest of the breakwater was made only four feet higher than the mean sea level and was provided with a special energy dissipator. Tests were made on the new breakwater in early 1977 using irregular waves. These tests show complete efficiency with a total dissipation of energy, even for the highest waves permitted by the existent depth. Under extreme conditions when the mean sea level was higher than breakwater crest, the wave height on the sheltered side was less than two feet. It was estimated that the cost of the traditional intake at this particular site would be about 20 million dollars. The cost associated with the described solution has been around 5 million dollars, and it provides the added benefit of mooring berths being made available. (Baker-FRC)
W83-02795

8B. Hydraulics

SPILLWAY AERATION OF THE SAN ROQUE PROJECT,
Electroconsult, Milan (Italy).
L. Eccher, and A. Siegenthaler.
International Water Power and Dam Construction, Vol 34, No 9, p 37-40, September, 1982. 11 Fig.

Descriptors: *Spillways, *Aeration devices, *Cavitation, Erosion, San Roque, *Philippines, Dam Design, Hydraulic structures.

An aeration device for the open chute spillway at the San Roque project, Lower Agno River, Luzon, Philippines, was designed to prevent cavitation erosion of the spillway surface. Aeration devices produce a local pressure drop so that air is sucked into the flow to produce a compressible, impact-absorbing air-water mixture. The design was developed by testing in a 1:25 scale hydraulic model. Experiments showed that the depression in the air space under the nappe was strongly influenced by pressure losses along the air supply system. Air demand increased with increasing deflector height up to the limiting height of 0.75 m, above which the air demand remained constant. The air demand was a function of the flow velocity, not of the specific discharge. Three basic types of air slots were evaluated: groove, deflector, offset, and their combinations. The final design was a combination of an offset 0.75 m high and a deflector 0.5 m high. Spacing of the air slot was 50 m for mean flow velocities between 30 and 40 m per sec and 50 m for higher flow velocities. (Cassar-FRC)
W83-02540

MODELING OF WATERCOURSE CLOSURE (MODELISATION DE FERMETURE DES COURS D'EAU),
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
K. Rohan.
Canadian Journal of Civil Engineering, Vol 9, No 2, p 156-169, June, 1982. 14 Fig, 15 Ref.

Descriptors: *Dams, *Construction, Design criteria, Dam collapse, Rockfill dams, Economic factors, Powerplants, Bottom roughness, Sediment transport.

In general a progressive lateral dumping of stones is considered for the construction of a rockfill dam in flowing water to accomplish river closure or repair a dam collapse. The aim of the present laboratory study was to determine an economical procedure for application to an actual powerplant structure and, if possible, to draw some conclusions of general validity. Scale modeling techniques of river parameters were well understood from the application of the laws of similarity of hydraulic flow and of bed load transport. It appeared to be more difficult to extrapolate the results from scale model studies of a river closure because of the uncertainty of extrapolation of some physical factors such as turbulence intensity, form coefficient of solid material, friction and inertia forces of dumped particles, and their stability in connection with bottom roughness. The same uncertainty also exists in the extrapolation of the duration of closure for a specific frequency of dumping. (Baker-FRC)
W83-02614

ESTIMATION OF THE SIZE AND ROUGHNESS OF SEDIMENTS IN HYDRAULIC CALCULATIONS,
A. B. Veksler, and V. M. Donenberg.
Hydrotechnical Construciton, No 9, p 924-930, September, 1980. 4 Fig, 3 Tab, 12 Ref. Translated from Gidrotekhicheskoe Stroitel'stvo, No 9, p 29-33, September, 1980.

Descriptors: *Particle size, *Sediment grading, *Soil physical properties, Screens, Roughness coefficient.

Sediment particle size may be described in several ways: nominal diameter (diameter of a sphere of the same volume as the particle), screening diameter, sedimentation diameter (diameter of a sphere of the same density and settling velocity as the investigated particle), standard sediment diameter (diameter of a 2.65 g per cu cm density sphere with the same settling velocity as the particle at 24C, and reduced diameter (diameter of a sphere whose volume is the mean statistical volume of particles of a given fraction). This paper reviews the discrepancies obtained when using screens of square or round holes and of woven or drilled construction. The authors suggest that the reduced diameter concept accounts for the differences in determination of particle size with screens of different hole shape, avoids conflicting recommendations, and increases the accuracy of roughness estimates. (Cassar-FRC)
W83-02622

SURGES OF FINITE HEIGHT,
Alberta Univ., Edmonton.
N. Rajaratnam.
International Water Power and Dam Construction, Vol 34, No 11, p 45-46, 1982. 3 Fig, 1 Ref.

Descriptors: *Surges, *Mathematical studies, Channel flow, Hydrodynamics, Waves, Wind tides, Storm surges, Hydraulics, Channels.

Diagrams are presented for predicting the characteristics of the surge produced by the reflection of a surge of finite height at a dead-end, and also for the surges produced by the collision between two surges of finite height. A surge is considered of finite height advancing with an absolute speed into a dead-end with a given depth in a rectangular channel. The surge is reflected at the dead-end and the height and speed of this reflected surge is determined. Similar diagrams can be developed to predict the behavior of surges of finite height at channel bifurcations and at steps. (Baker-FRC)
W83-02631

ANALYSIS OF A FINITE ELEMENT ALGORITHM FOR NUMERICAL PREDICTIONS IN WATER RESOURCES RESEARCH,
Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
A. J. Baker, and M. O. Soliman.
Advances in Water Resources, Vol 5, No 3, p 149-155, September, 1982. 8 Fig, 12 Ref.

Descriptors: *Finite element analysis, *Algorithms, Water resources, Computers, Mathematical equations, Model studies, Hydrodynamics, *Fluid mechanics, Flow, *Prediction.

Pertinent results are highlighted on the assessment of accuracy, convergence and utility of a finite element algorithm for application to prediction of fluid dynamics phenomena in water resources applications. The findings illustrate the versatility of the developed algorithm for parametric studies in three-dimensional hydrodynamic transport. The diffusion and convection phenomena, inseparable in the physical simulation, can be individually analyzed using sufficiently high order accurate algorithm. The error produced using any consistent numerical algorithm is controllable with discretization refinement, but computer resource constraints place a severe limitation on the number of solution nodes for three dimensional flows. The examples cited employed 4913 node points, with the dependent variable, plus three velocity and three diffusion coefficients defined at each node, plus various geometry information. (Baker-FRC)
W83-02656

NUMERICAL CONVOLUTION FOR SOLUTION OF WAVE PROPAGATION PROBLEMS: FILTER SCHEME METHODS,
Texas A and M Univ., College Station. Dept. of Oceanography.
R. O. Reid, and D. R. Basco.

Journal of Hydraulic Research, Vol 20, No 4, p 329-349, 1982. 11 Fig, 1 Tab, 14 Ref.

Descriptors: *Wave propagation, Mathematical equations, *Numerical convolution, Hydraulics, Model studies, *Filters, Differential equations.

Filter scheme methods are numerical convolution techniques for the solution of partial differential equations and are fundamentally different from finite- difference or finite-element methods. The basic concept is that the output of any physical system can be calculated from the input if the response function is known for the system. The process becomes one of the convoluting the unknown variables over the space domain with a weighting function which is the Fourier transform of the response function. The method is studied for the simple one dimensional advection problem. The raw Fourier coefficients are found analytically but require smoothing by an appropriate taper function to produce a stable scheme for all wave numbers because of Gibb's effects near the Nyquist frequency. A constraining technique is also used near the very long wave scales to improve phase response of the filter. The method is shown to possess excellent numerical ability to accurately propagate very short waves associated with spiked or stepped functions. Comparisons with various common finite-difference schemes, under conditions of equal computation effort, demonstrate the filter scheme's superiority in this regard. The method can be extended to more general cases for which analytical solutions are not available. (Baker-FRC)
W83-02672

THIN SLENDER WATER JETS,
Adelaide Univ. (Australia). Dept. of Applied Mathematics.
M. S. Borgas, and E. O. Tuck.
Journal of Fluid Mechanics, Vol 119, p 379-391, 1982. 8 Fig, 9 Ref.

Descriptors: *Mathematical equations, *Jets, *Nozzles, *Velocity, *Flow, Physcial properties, Engineering, Mathematical studies, Fluid mechanics.

An analysis is provided for the free development of slender jets of water in which the cross-sections are of small thickness-to-width ratio. For simplicity, gravity is ignored, and it is assumed that the main jet is straight, lying close to the x-axis, and thinner in the z-direction than in the y-direction. The most important determinant of the jet's cross-section is the lateral velocity. Equations are presented for free jets. Examination of quadratic lateral velocity profiles gives further insight into the behavior of thin jets. Equations describing flow in thin slender nozzles are also presented. (Small-FRC)
W83-02677

FLUVIAL HYDRAULICS OF DELTAS AND ALLUVIAL FANS,
San Diego State Univ., CA. Dept. of Civil Engineering.
H. H. Chang.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1282-1295, November, 1982. 7 Fig, 1 Tab, 11 Ref.

Descriptors: *Fluvial sediments, *Hydraulics, Flow characteristics, Fluid mechanics, Alluvial fans, Alluvial channels, Channels, Sedimentation, Erosion.

Delta formation and its associated stream channel hydraulics have been studied using data obtained in a large laboratory flume. The findings for deltas are generally applicable to alluvial fans. Delta or fan shape is directly related to the pattern of stream flow, its loci and mode of deposition. Under constant conditions, a stream channel on the delta usually has multiple branches. Compared with the single channel of the upstream reach, the branched channel has a similar energy gradient but a lower velocity and sediment load, indicating that deposition on the delta is not due to sudden reduction in energy gradient but due to the change in hydraulic geometry and its associated reductions in velocity and sediment load. Under steady conditions, minimum stream power for a channel system is equivalent to the energy gradient or equal power expenditure per unit channel length along the channel. A change imposed on the channel system, such as a rising base level, a decreasing discharge, or an increasing sediment inflow, usually results in a lower energy gradient for the stream on the delta in relation to the upstream reach. Channel adjustment through widening or branching into distributary channels provides greater flow resistance and power expenditure for the delta stream, while its increased backwater effect decreases the power expenditure of the adjacent upstream reach. This process results in a more uniform power expenditure along the channel, while total power of the system is minimized. It was concluded that the stream channel changes reflect the stream's tendency to seek equal power expenditure along the channel. (Baker-FRC)
W83-02678

SALTATION IN WATER DYNAMICS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
P. J. Murphy, and H. Hooshiari.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY11, p 1251-1267, November, 1982. 10 Fig, 1 Tab, 17 Ref.

Descriptors: *Saltation, *Flow discharge, *Bed load, Sedimentation, Sediment load, Drag, Force, Channels, Channel flow, Dynamics, Hydrodynamics, Fluid mechanics.

An evaluation of the fluid forces exerted on a bed load particle is presented. The study used strobe photography to measure the kinematics of a sphere moving via saltation along the bed of an open channel flow. It was determined that an idealized gravel stream bed with a flow so strong that an exposed particle moves as bed load but not as suspended load can be described with a dynamic model that uses the particle's weight, the bed-impact force, and the fluid force due to the mean fluid flow. The force exerted on the particle by the moving fluid was composed of the effects of buoyance, added mass, and drag. The Magnus effect and the wall effect forces were not consistent with the observed data. The added mass force has two parts, one commonly used to describe added mass and horizontal force due to the motion of the particle across the mean fluid velocity gradient. This effect of the mean shear should be included in the equations of particle motion in sedimnt transport. Since the particle motion is determined by the flow, a given set of flow and bed conditions will permit trajectory sizes up to some maximum size. A reasonable distinction between particles deposited in a pit trap by the saltation and suspension processes might be whether their trajectory length is greater of less than the maximum saltation length. (Baker-FRC)
W83-02679

FLOW COMPUTATION USING EXTRAPOLATION PROCEDURES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2E.
W83-02695

LATERAL BED LOAD TRANSPORT ON SIDE SLOPES,
Saitama Univ. (Japan). Dept. of Foundation Engineering.
S. Ikeda.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No 11, p 1369-1373, 1982. 3 Fig, 8 Ref.

Descriptors: *Mathematical equations, *Bed load, *Sediment transport, Sedimentation, River beds, Bottom sediment, Canals, Model studies, Design criteria, Rivers, Banks.

Several difficulties are expected when estimating the lateral bed load transport rate. One is the problem of shear stress estimation on side slopes, and the other is the measurement of the lateral bed load transport rate. Immediate measurement of both is fairly difficult in open channel flows, and considerable error would be expected. To reduce these difficulties a laterally inclinable wind tunnel was used in the present study. After a steady sand movement with the airflow was achieved, laterally moving sand particles were collected. These data were supplemented with data on the variation of lateral bed profile with the time from a series of experiments on self-formed straight channels in sand beds. The lateral bed load transport rate increases in proportion to the tangent of the angle of inclination, and a duBoys' type bed load junction was proposed to express the experimental results. This formula should contribute to bank protection engineering, estimation of stable bed profile, and prediction of river migration rate. (Baker-FRC)
W83-02709

8C. Hydraulic Machinery

EXPERIENCE CURVES FOR FEASIBILITY STUDIES AND PLANNING OF MODERN LOW-HEAD HYDRO TURBINES,
Idaho Univ., Moscow. Dept. of Civil Engineering.
C. S. K. Kpordze, and C. C. Warnick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-186130, Price codes: A07 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute Completion Report, Moscow, December 1982. 120 p, 42 Fig, 8 Tab, 23 Ref. OWRT A-077-IDA(1), 14-34-0001-2114.

Descriptors: Hydroelectric plants, *Turbines, Avial flow turbines, *Bulb turbines, *Tube turbines, *Low-head turbines, Design, Feasibility studies.

Results are presented of an extensive investigation of the characteristics of over two hundred low-head turbines maufactured all over the world that have been installed or are due to be installed in hydropower plants between 1953 and 1984. The research focused mainly on bulb turbines, with horizontal shaft arrangement, and tubular turbines with their shafts either horizontal or included at an angle to the horizontal. The characteristics of the above mentioned type of turbines are presented in the form of statistical diagrams and regression equations suitable for preliminary design and feasibility studies of low-head hydro projects. Nomographs have been developed for displaying the relationships between the various turbine characteristics and comparing the important dimensions and parameters of turbines which have found common application in the hydropower technology. New simplified parametric ratio for selection of turbines have been developed that should expedite preliminary selection study for hydropower projects.
W83-02489

WATERFLOW CONTROL,
International Water Power and Dam Construction, Vol 34, No 6, p 29, June, 1982.

Descriptors: *Hydraulic equipment, *Hydraulic valves, *Flow control, Hydroelectric plants, Hydroelectric power, Design criteria, Flow discharge.

The butterfly valve is one of the simplest and best valves for the control of water flow in hydropower installations. Its basic design is a circular disc rotating within a cylindrical bore. The development of better materials and improved design processes has extended the use of butterfly valves to new applications. Special coatings allow the valves to handle water with heavy sediment loads or high salt contents. Standard bearings are made of Franberlube (graphite-impregnated phosphor-bronze), and valves for seawater applications of Ferrobestos (impregnated asbestos braiding). The blade is usually cast from spheroidal graphite iron. The seal is usually made from a neoprene-type material or a metal. The time involved in manufac-

turing a butterfly valve depends on whether the order calls for a standard model or a new design. Typical closure times are between 50 and 400 sec. Actuators are sized in accordance with required closure times. Typically, actuators are supplied by Rotork or Limitorque. Butterfly valves are one-fourth the size and weight of corresponding gate valves. They are simple to operate, with a minimal number of moving parts, and give reduced vibration of flutter. The streamlined body of the valve offers reduced pressure drop and good flow characteristics and their seals can be easily adjusted or replaced. Butterfly valves also save civil engineering costs compared with aluice valves. (Geiger-FRC)
W83-02534

FLOW MEASUREMENTS AT RACCOON MOUNTAIN,
Tennessee Valley Authority, Norris. Engineering Lab.
P. A. March.
International Water Power and Dam Construction, Vol 34, No 10, p 42-44, October, 1982. 3 Fig, 2 Tab, 2 Ref.

Descriptors: *Flow measurement, *Performance evaluation, *Hydraulic equipment, *Pump turbines, *Flow rates, *Pumped storage, Flowmeters, Aerial photography, Mathematical studies, Volumetric analysis, Storage reservoirs.

Flow measurements were made by three different techniques on unit number 1 of the 385 MW pump-turbines to establish efficiency curves for the Raccoon Mountain pumped-storage plant. In the Winter-Kennedy method, differential pressures in the unit 1 spiral case were measured with a servo-type water-over-mercury, differential manometer attached to two piezometer taps. Equations are given for tap calibration. In the acoustic flowmeter method, flow was measured by a four-path acoustic flowmeter with transducers mounted in a section of 3m-diameter conduit connecting the spiral case and the spherical valve. A volumetric method was used with the aid of aerial photogrammetry conducted before the reservoir was filled. Mathematical calculations were also required to compute flow rates. Other measurements needed for calculating unit efficiences included power output and input data, headwater and tailwater readings, net head efficiencies in the generating mode, and total head efficiencies in the pumping mode. Results showed that generating efficiencies based on the Winter-Kennedy method ranged from 0.876 to 0.916, while those calculated by the acoustic flowmeter ranged from 0.867 to 0.909. Flow rates measured using the Winter-Kennedy method averaged about 1.9% lower than those measured with the acoustic flowmeter, while flow rates measured with the volumetric method averaged about 1.7% higher than those measured by acoustic flowmeter. The overall uncertainties in the Winter-Kennedy and the acoustic flowmeter methods could be reduced by better calibration. Uncertainties in the volumetric method could be reduced with more specialized aerial techniques. (Geiger-FRC)
W83-02535

DEVELOPMENTS IN PUMP-TURBINES,
Ljubljana Univ. (Yugoslavia). Faculty of Engineering.
F. Schweiger, and J. Gregori.
International Water Power and Dam Construction, Vol 34, No 10, p 22-25, October, 1982. 7 Fig, 14 Ref.

Descriptors: *Turbines, *Pumped storage, Pump turbines, Design criteria, Hydroelectric plants, Hydraulic machinery, Powerplants, Graphical analysis, Statistical analysis, Specific speed, Flow coefficient, Pumping head, Energy coefficient.

Data on pump-turbine units collected from manufacturing plants are statistically analyzed to discern current trends in development. Although a wide range of specific speeds are covered, most are concentrated within 25-60. Graphs are presented for pump head vs. specific speed for 3 periods (before 1970, 1970-75, and after 1975). Specific speed has increased with constant pump head, showing that recently designed units can take higher loads. Further graphs and equations are given for specific speed vs. energy coefficient, flow coefficient, diameter ratios, and height ratio. A family of curves, called a type graph, for specific diameter vs. specific speed can be used for calculating basin runner diameters and to follow the systematic development of reversible units. (Cassar-FRC)
W83-02536

UNIQUE DESIGN FOR GUIJO DE GRANADILLA,
Hidroelectrica Espanola, Madrid.
J. deR. Sirougnet, P. M. Ruas, L. Becke, E. Randegger, and F. Mez.
International Water Power and Dam Construction, Vol 34, No 10, p 15-22, October, 1982. 13 Fig.

Descriptors: *Turbines, *Pumped storage, *Hydroelectric plants, Pump turbines, Dams, Irrigation, Hydraulic machinery, Hydraulic turbines, Powerplants, Multipurpose projects, Guijo de Granadilla Dam, Grabriel y Galan Dam, Valdeobispo Dam, *Spain.

A new pump-turbine of the bulb type was developed for the Guijo de Granadilla power facility, part of the 3-dam Gabriel y Galan-Valdeobispo hydroelectric and irrigation system on the Alagon River in Spain. A mixed pumped storage scheme was designed to allow power stations to operate independently of irrigation requirements. The electric generating system is operated over a few peak hours only on working days, whereas the irrigation demands vary widely during the year. Each of the 2 reversible 27 MW bulb sets at Guijo de Granadilla has a diagonal runner with adjustable blades and a fixed distributor. The design allows regulation of both turbine and pumping water discharge within a wide range by modifying the runner blade positions while maintaining high operational efficiency. Model development tests and design concepts are described in detail. Special features include electronic control of the runner blades, minimum power consumption during startup, design of radial bearings and double-sided tilting segment thrust bearings for two directions of rotation, provision for interim lubrication of bearings by high-level oil tanks in case of power failure, an axial sliding ring seal on the shaft, and a standstill seal. (Cassar-FRC)
W83-02538

USE OF ENERGY STORAGE BY INCREASING THE HEAD OF THE HYDROELECTRIC STATION-PUMPED STORAGE STATION,
L. A. Karol.
Hydrotechnical Construction, No 2, p 182-183, February, 1980. 2 Fig, 3 Ref. Translated from Gidroteknicheskoe Stroitel'stvo, No 2, p 44-45, February, 1980.

Descriptors: *Pumped storage, *Pump turbines, *Hydroelectric plants, Turbines, Low head dams.

A pumped storage scheme is proposed for use in flatland regions, at sites where one of the banks is steep enough and has an area for creating an upper reservoir. Reversible mixed-flow pump turbines sets are available for heads of 100 m. This system directs water flow by manipulation of gates and draft-tube intakes. In a pump regime the water flows from the upper pool through an intake and is directed, not immediately to the scroll casing of the reversible unit, but to specially constructed pump part of the draft tube of the unit. (Cassar-FRC)
W83-02620

ASPECTS OF THE MACHINE FOUNDATION DESIGN AT DRAKENSBERG,
Electricity Supply Commission, Johannesburg (South Africa).
N. J. Terblanche.
Civil Engineer in South Africa, Vol 24, No 8, p 449, 451-454, August, 1982. 6 Fig, 13 Ref.

Descriptors: *Pumped storage, *Hydraulic machinery, *Underground structures, Strain, Stress, Drakensberg Pumped Storage Scheme, *South Africa, Foundations, Valves, Concrete technology, Rigid foundations, Pump turbines, Turbines.

The design and development of the foundations and surrounds of the pump-turbines, generator-motors, and spherical valves for the Drakensberg Pumped Storage Scheme, South Africa, are described. The underground structures were built in weak sandstones, siltstones, and mudstones, which restricted the sizes of the machine hall and other excavations. The bolts holding down the valves were designed to restrain the uplift and horizontal displacement caused by valve closure and the extension of the free straining penstock. In the pump-turbine foundations loads on the concrete were reduced and concrete strength maximized by embedding the spiral in carefully controlled stages under pressure. The generator-motors are contained in 12-sided concrete housings (barrels), which are connected with the underlying pump-turbine foundations and the overhead operating floor. A layer of thermal insulation 70 mm thick was placed inside the barrel to reduce the temperature difference of 50C, produced when cooling fans turn on at the maximum operating temperature. Instrumentation of one machine foundation permitted study of loads, stresses, strains, and temperature effects. (Cassar-FRC)
W83-02667

MAINTAINING DISTRIBUTION SYSTEM VALVES AND FIRE HYDRANTS,
Saint Louis County Water Co., University City, MO.
B. W. Franklin.
Journal of the American Water Works Association, Vol 74, No 11, p 576-579, November, 1982. 7 Ref.

Descriptors: *Valves, *Water distribution *Maintenance, *Hydrants, Pipes, Corrosion, Costs, Water loss, Leakage, Safety, Hydraulic valves, St. Louis, Missouri.

Experiences of the St. Louis County Water Company are presented, with emphasis on their ongoing maintenance program for valves and fire hydrants and on the procedures recommemded for maintenance by the industry. The system contains about 5280 km of pipeline ranging in size from 40 mm to 1050 mm pipe, and having 257,000 customer service connections, 21,400 fire hydrants, and about 40,000 valves. Various types of valves used include gate, butterfly, check, and ball. Some plug and cone valves are used for water flow control at plant and storage facilities. A good valve maintenance program begins with good installation. Ideally, valves should not be buried under excessive fill, should be set near intersecting streets or fire hydrants to facilitate location in the future, and should have marker stakes set on cross-country lines. Road improvements in the St. Louis County Water Co's service area require constant attention from the utility to ensure that valves are not lost. Corrosion is a problem in some areas and causes failure of bonnet and packing gland bolts. Gate valves that are about 50 years old or more are causing the most problems. Stem breakage in the 100 and 150 mm sizes is a common problem, as is difficulty with exposed gears and complete seating in larger sized valves. The American Water Works Association Standard C500-80 recommends that valves be exercised regularly through one complete operating cycle to prevent buildup of tuberculation and other deposits that would render the valve inoperable or would prevent a tight shutoff. The St. Louis County Water Co. has a program to operate all valves that are 400 mm or larger in main transmission lines and all branch lines yearly. Hydrants, like valves, should be maintained regularly to keep them serviceable. (Baker-FRC)
W83-02714

PROJECT STUDIES AND RESEARCH WORK CONCERNING BUTTERFLY VALVES AS USED IN WATER POWER STATIONS AND RETARDING BASINS (PLANUNGSKRITERIEN UND FORSCHUNG BEI DROSSELKLAPPEN FUR KRAFTWERKSANLAGEN UND RUCKHALTEBECKEN),

Technische Hochschule, Darmstadt (Germany, F.R.). Fachgebiet Hydraulische Maschien und Anlagen.
J. Osterwalder.
Wasserwirtschaft, Vol 71, No 12, p 368-372, December, 1981. 7 Fig, 1 Tab, 8 Ref. English summary.

Descriptors: *Butterfly valves, *Design criteria, *Powerplants, Hydroelectric powerplants, Valves, Retarding basins, Mechanical equipment.

Butterfly valves have to fulfill various requirements depending on the scope of application and specifications. Questions in connection with plant security, aspects of economy and hydraulic behavior are usually of great importance during the planning of a project. It is well known that corresponding answers can only be based on experimental investigations with models. In case of butterly valves for water power stations there are numerous useful publications. However, little information is available concerning butterfly valves with eccentrical shutters as they are often used for retarding basins. Recent research in this field is reviewed in this paper. Such model tests already enable a judgment of the situation to be made as accurately as possible. In many cases necessary constructive changes or modifications of the design can be recognized early enough to accomplish suitable corrections. One must keep in mind that the importance of such butterfly valves should not be judged according to their relatively low costs but rather in connection with the problems they can produce in case of failure. (Baker-FRC)
W83-02761

INSPECTION AND MAINTENANCE OF DAM DEWATERING FACILITIES,
Collins Engineers, Inc., Chicago, IL.
T. J. Collins.
Public Works, Vol 113, No 12, p 28-31, December, 1982. 4 Fig.

Descriptors: *Inspection, Reservoirs, *Outlets, Hydraulic gates, *Gates, *Dams, Corrosion, Diving, Dewatering, Water level, Maintenance, Photography.

Engineer-divers inspect equipment used for emergency dam dewatering structures prior to operating them. During the under water inspection, the diver can determine if the mechanisms can be safely operated. Debris removal and minor repairs and adjustments can also be done at this time. Since these mechanisms are often hidden under water and are rarely operated, there is a risk of losing an entire water supply if a gate cannot be reclosed after initial opening. Common problems are concrete distress in the tower; deterioration, damage, and corrosion to gate components; clogging with debris; poor alignment of the gate stem guides; and strong currents in submerged outlet control works. Inspections are documented by photography, drawings, and/or reports. (Cassar-FRC)
W83-02770

IMPROVEMENT OF THE POWER OUTPUT OF HYDROELECTRIC PLANTS (VERBESSERUNG DER LEISTUNGSFAHIGKEIT VON WASSERKRAFTWERKEN),
E. Kossler.
Wasserwirtschaft, Vol 72, No 5, p 213-214, May 1982. 3 Fig. (No English Summary).

Descriptors: *Hydroelectric plants, *Hydraulic loss, *Turbines, *Planning, *Water resources development, Austria, Rivers, Hydraulic machinery, Hydroelectric power, Mechanical equipment, Electrical equipment, Design flow, Drop height.

Methods of improving the output of hydroelectric power plants are discussed, with emphasis on small plants as a partial answer to the energy crisis. Although no reliable statistics exist on the number of small plants that have fallen into disuse over the past decades, studies in Austria have shown that careful planning could double or triple the power output potential of rivers. Large-scale measures, comprising assessment of the current situation and extensive planning, are problematic due to such considerations as water quality and the flooding of agricultural land, as well as the recent tendency to view rivers as nothing more than flood discharge channels. Cooperation between all interested groups is required to complete such projects. Measures specific to power plants include increasing the drop height, enlarging design flow, and reducing losses. The first of these is the most effective, since this influences output independent of water volume. This is especially true for low-pressure plants. It may be achieved by raising reservoir water level, deepening the underground channel, or merging drop stages. Enlargement of design flow is possible where the plant posseses its own weirs and the original turbines were built too small; in this case, new turbines are usually needed. Rivers are usually best exploited by means of a chain of weir power staions. The third possibility involves an examination of hydraulic, mechanical, and electrical losses. For the first type of loss, emphasis should lie with the turbines, where a bad hydraulic profile in the regulating devices and air wheel, rough surfaces in the high-speed region (due to rust, erosion, or cavitation), badly installed double regulation, the incorrect rate of revolution, and other problems may reduce efficiency. Problems in mechanical translation and in the electrical system (generator, transformer) are not as important as hydraulic failures. (Gish-FRC)
W83-02800

8D. Soil Mechanics

SEISMICITY INDUCED BY THE RESERVOIR LG-2 (LA SEISMICITE PROVOQUEE AU RESERVOIR LG-2)
Department of Energy, Mines and Resources, Ottawa (Ontario). Seismology and Geothermal Studies Div.
G. G. R. Buchbinder, F. M. Anglin, and R. McNicoll.
Canadian Journal of Earth Sciences, Vol 18, No 4, p 693-698, April, 1981. 6 Fig, 7 Ref.

Descriptors: *Rockfill dams, *Earth dams, *Reservoir stages, *Reservoirs, *Earthquakes, Storage reservoirs, Seismic waves, Dams, Earth pressure, Geologic faults, La Grande River, *Quebec, Canada.

The construction of a rock and earth-filled dam in the La Grande River valley, Quebec, has created a hydroelectric reservoir with a maximum depth of 145 m and a volume of 61.7 times 10 to the 9th power cu m. No seismicity in the Precambrian Shield region above the magnitude 0.1 was observed in the reservoir zone in the 27 months preceding the filling. Microearthquakes of magnitude less than one started under the reservoir when a water depth of 90 m was reached, after 30 days, and this activity continued for about three months. A second series of microearthquakes began in the same active zone when the rate of filling increased twofold. The seismically active area is confined to a zone 4 km x 7 km and no deeper than 5 km. The microearthquakes are considered to be the result of minor reactivation of old faults under the reservoir in response to the increased pore pressure. (Author's abstract)
W83-02575

LONG-TERM MONITORING OF EMBANKMENT DAMS IN BRITAIN,
A. D. M. Penman, and M. F. Kennard.
International Water Power and Dam Construction, Vol 34, No 11, p 19-26, 1982. 10 Fig, 23 Ref.

Descriptors: *Monitoring, *Dam failure, *Piezometers, *Pressure-measuring instruments, *Dam stability, Dam design, *Rock mechanics, *Pore pressure, Dams, Dam construction, Earth dams, Rockfill dams, Drainage, Reservoirs, Embankments, *Great Britain.

In 1930, following several dam failures, Parliament passed the Reservoirs (Safety Provisions) Act. The act requires British dams impounding more than 22,500 cu m to be entrusted to a reservoir engineer and be inspected at least every 10 years. The Reservoirs Act of 1975 has required the installation of monitoring instruments in British dams. Piezometers were installed in the Usk and Daer dams. They were of the two-tube design, and the addition of a Bishop filter allowed them to measure pore water suctions and pressures. A piezometer tubing of Nylon 11 coated with polyethylene was needed to prevent air bubbles in the piezometers, and a mercury manometer was adopted to measure pressure. The first results of monitoring indicated a need for filter drainage layers in the Usk dam. Such a drainage system was also installed at the Selset Dam, and one is now being installed at the Carsinton dam. In dams built between 1955 and 1965, instruments were installed to measure total stress. When the Balderhead dam showed signs of increased seepage and distress, a slurry trench cut-off on the core centerline was implemented. After failure of the dam, further pressure measurements were required to monitor dam stability. Adjustments of the rolled clay cores were also made at the Llyn Brianne and Scammonden dams, where additional total surveying targets allowed the recording of deflections in the downstream face of the cores of both dams during the first reservoir filling. Some specifications for clay cores, contact pressure considerations, and the operation of dam monitoring instruments are discussed. (Geiger-FRC)
W83-02628

MONITORING DAMS AND THEIR FOUNDATIONS,
A. Marazio.
International Water Power and Dam Construction, Vol 34, No 11, p 17, 1982.

Descriptors: *Dam construction, *Dam foundations, *Dam stability, *Rock mechanics, *Data collections, *International commissions, Design criteria, Dam design, Earth dams, Rockfill dams, Seismology, Concrete dams, Safety.

In 1982, ICOLD set up a committee to monitor dams and their foundations. The committee plans to update the criteria to establish an appropriate system for monitoring concrete and earthfill dams. Information will be collated and instrumentation methods available today and on the reliability of state-of-the-art techniques. The committee must also collect data from continuous recording systems such as seismic monitoring, and collate some case histories of old dams to serve as references. The safety of many old dams is questionable. Many made of earth and rockfill material, which calls for new safety measures. The acquisition of stress-strain patterns made it possible to understand the importance of dam foundation in relation to dam performance. Other instruments such as inverted plumb lines, rockmeters, and measuring and collecting systems have also been invented specifically for monitoring dam safety. Today dam operation may be simulated by numerical models. Existing dams can serve as prototypes for future dams. (Gieger-FRC)
W83-02629

NORWEGIAN PRACTICE IN INSTRUMENTING DAMS,
State Power System, Oslo (Norway).
For primary bibliographic entry see Field 8G.
W83-02630

TECHNOLOGY–WHAT IS IT FOR. TWO EXAMPLES FROM THE MORE THAN 2,000-YEAR HISTORY OF HYDRAULIC ENGINEERING IN CHINA (TECHNIK WOZU. ZWEI BEISPIELE AUS DER UBER 2000JAHRIGEN GESCHICHTE DES WASSERBAUES IN CHINA),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Hydromechanik und Wasserwirtschaft.
For primary bibliographic entry see Field 8A.
W83-02760

8E. Rock Mechanics and Geology

SURGE CHAMBER DESIGN FOR JUKLA,
Geoteam A/S, Oslo (Norway).
J. Bergh-Christensen.
International Water Power and Dam Construction, Vol 34, No 10, p 39-41, October, 1982. 8 Fig.

Descriptors: *Pumped storage, *Rock excavation, *Surge chambers, Rock bolts, Rock properties, Hydroelectric plants, Excavation, Jukla, Norway.

An unlined compressed air surge chamber for Norway's Jukla pumped storage plant was excavated in 1972-73. The 128 sq m cross section, 48 m long chamber has had no appreciable air losses at groundwater heads of 17 kg per sq cm or less and 20-200 normal liters per min at higher pressures. No reinforcement or sealing was necessary, except for grouted rock bolts in the roof. Preliminary tests in two 46 m and 67 m sections had shown that water at pressures up to 50 kg per sq cm produced losses corresponding to Lugeon values of 0.0002-0.0015. Air leakage at pressures up to 40 kg sq cm was 6-215 normal liters per min. (Cassar-FRC)
W83-02572

EMBANKMENT DAMS OF PAZ CASCADE OF HYDROPOWER STATIONS AND SOME CONCLUSIONS FROM THEIR OPERATIONAL EXPERIENCE,
D. M. Yashkul.
Hydrotechnical Construction, No 11, p 1140-1148, November, 1980. 3 Fig, 2 Tab, 5 Ref. Translated from Gidroteknicheskoe Stroitel'stvo, No 11, p 24-29, November, 1980.

Descriptors: *Dam design, *Earth dams, *Drainage, Paz Cascade, *USSR, Embankments, Seepage, Rock fill, Vegetation, Slope stabilization.

The eight earthen dams comprising the Paz cascade on the Kola Peninsula, USSR, have maintained their integrity in the years since construction, 1951-1970. The embankments, varying from 18 to 2925 m crest length and from 13 to 22 m in height, were constructed of heterogeneous moraine soil placed by dry compaction. Crest deformations were significant. Seepage discharges were small, 1 liter per sec per 100 m length of crest in dams with a cut-off element and 2 liters per sec per 100 m length in dams with cores. Junctions between dam and concrete headworks using retaining walls had the worst antiseepage properties. Natural stone slabs used to protect dam slopes were subject to collapse on the downstream side and slumping on the upstream side. Snowing grasses to stabilize slopes was ineffective on the northern-facing slopes--only moss survived. Organic matter and topsoil lodging in the dam slopes and crest promoted infestations by woody shrubs, difficult to keep under control. In some dams the drainage water outlets caused water accumulation, seepage, and siltation. Maintenance for the group of dams required 35-60 man days per year. (Cassar-FRC)
W83-02593

CURRENT REQUIREMENTS IMPOSED ON THE CONTACT OF GRAVITY AND BUTTRESS DAMS WITH ROCK FOUNDATIONS,
Yu. A. Fishman.
Hydrotechnical Construction, No 11, p 1120-1125, November, 1980. 1 Fig, 1 Tab, 14 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 11, p 12-16, November, 1980.

Descriptors: *Rock foundations, *Dam foundations, *Concrete dams, Gravity dams, Buttress dams, Dam stability, Dam failure, Dam design, Foundation failure, Foundation rocks, Drainage, Compressibility, Shear stress, Grouting, Deformation.

Design of dams to prevent failure at the concrete-rock foundation interface should consider not only the shear stresses but rotation (eccentric compression) in the contact section. The deformability of the rock foundation is an important factor in dam stability. Various engineering measures are evaluated. Rock under a dam base should be excavated if intensely weathered. Permeable and deformable rocks should not be automatically removed. Permeable rocks can enhance seepage drainage, and deformable rocks can favorably distribute stresses. It is sufficient to remove weak rock only under the downstream face, but it is not permissible to remove rocks from the upstream side, leaving weak rocks on the downstream side. Concrete in the contact zone should be high-grade in the downstream face and highly elastic over the entire base, especially near the upstream face. Grouting should be limited to about 1/3 of the dam width on the downstream face only. Construction of a reversed gradient of the base and upstream cutoff walls are practically useless. Dams anchored on the upstream side have increased protection against rotation; downstream anchoring is ineffective and is not recommended. Cutoff walls are not necessary for poorly permeable or nonpiping rock foundations. Often a small (to 10% of the height) upstream blanket can supplement or replace the cutoff wall. Drainage measures, such as curtain or drainage cavities, are effective and reliable means of reducing the uplift pressure on dam bases. Curtain drains should be located under the upstream face or, in some cases, the middle of the dam, rarely under the downstream face. (Cassar-FRC)
W83-02595

INSTRUMENTING AUSTRALIA'S CETHANA DAM,
Tasmania Hydro-Electric Commission, Hobart (Australia).
For primary bibliographic entry see Field 8A.
W83-02603

MODELING OF WATERCOURSE CLOSURE (MODELISATION DE FERMETURE DES COURS D'EAU),
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W83-02614

MONITORING DAMS AND THEIR FOUNDATIONS,
For primary bibliographic entry see Field 8D.
W83-02629

ROCK ENGINEERING INVESTIGATION AND DESIGN STUDIES FOR THE DRAKENSBERG PUMPED STORAGE SCHEME,
J. C. Sharp, and T. W. Mellors.
Civil Engineer in South Africa, Vol 24, No 8, p 399-400, 403, 405-409, 411-413,416, August, 1982. 17 Fig, 15 Ref.

Descriptors: *Rock excavation, *Underground structures, *Tunnels, Excavation, Drakensberg Pumped Storage Scheme, *South Africa, Pumped storage, Powerplants, Construction.

Unfavorable geological conditions required extensive exploratory studies for the underground works of the Drakensberg Pumped Storage Scheme, South Africa. About 5 km of tunnels and caverns were designed for construction in weak mudstones, siltstones, and sandstones. In addition to aerial and satellite photography, geological mapping, exploratory boreholes, geophysical surveying, magnetometer surveying, and mineralogic studies, full-scale trial prototypes of the machine hall and pressure tunnels were constructed. The power station was excavated in series of separate caverns to minimize the size of the roof spans. Rock reinforcement and shotcrete linings permanently support the cavern roofs. (Cassar-FRC)
W83-02644

SEISMIC SAFETY ANALYSIS OF LOWER CRYSTAL SPRINGS DAM: A CASE HISTORY,
Wahler Associates, Palo Alto, CA.
E. Solomon, and J. Bahr.
Bulletin of the Association of Engineering Geologists, Vol 19, No 4, p 411-426, November, 1982. 9 Fig, 6 Tab, 11 Ref.

Descriptors: *Dams, *Stability, *Earthquakes, Lower Crystal Springs Dam, *California, Seismic analysis, Safety, Flood control, Food prevention, Maintenance, Construction, Soil properties, Sandstone.

The stability of the Lower Crystal Springs Dam 32 km south of San Francisco is crucial to the protection of large downstream populations that have grown up since the dam was built in 1890. A seismic safety evaluation was conducted during 1976 and 1977. Field investigations provided geologic data regarding the width of the fault zone in the reservoir area, located the 1906 line of ground rupture, explored the foundation bedrock at the dam site, and evaluated the potential for faulting beneath the dam. Hazards to the dam from anticipated movement on the San Andreas fault were also evaluated. Design earthquakes were applied to a finite element model of the dam and its foundation to permit analysis of the structure's dynamic response to severe earthquake shaking. It was concluded that the dam would be able to withstand an earthquake of 8.5 magnitude, and that the physical properties of the foundation rock - an apparently hard but microscopically brecciated sandstone - contribute significantly to the satisfactory response of the dam. Fracturing of the foundation graywacke accounts for the capacity of the rock to absorb strain energy. The number and relatively small volumes of existing landslide masses should not be able to generate a wave overtopping the dam.
W83-02663

CONSTRUCTION OF THE MAIN CIVIL WORKS OF THE DRAKENSBERG PUMPED STORAGE SCHEME,
For primary bibliographic entry see Field 8A.
W83-02665

8F. Concrete

SAFETY MONITORING OF CONCRETE DAMS,
Centro di Ricerca Idraulica e Strutturale, Milan (Italy).
M. Fanelli, and G. Giuseppetti.
International Water Power and Dam Construction, Vol 34, No 11, p 31-33, 1982. 11 Ref.

Descriptors: *Safety, *Monitoring, *Concrete dams, *Theoretical analysis, *Mathematical models, *Stress, *Dam stability, Dam construction, Dam design, Model studies, Mathematical studies, Numerical analysis, Simulation analysis.

A rationale is developed for a deterministic method of checking the safety of concrete dams. It is assumed in such a system that measurements can be recorded continuously and that the vectorial field displacement on the upstream face of the dam is known. The new model could only be conceivably applied to dams for which safety checks had been laid down before the dam was built. The theoretical basis of the new checking method is described mathematically in terms of an ideal breakdown of the displacement field, the breakdown of system stress, the system of stresses assuming elastic behavior, and the determination of field stresses. Many of these aspects can be clarified, in whole or in part, by suitable numerical simulation studies on a theoretical case which can easily be set up if all the analytical instruments required for conducting them already exist. The possibilities offered by the deterministic model used would be improved if the measurement data were more scattered geometrically, more reliable, and collected at the proper frequency. (Geiger-FRC)
W83-02632

ROCK BALLS AT FOLSOM DAM, CALIFORNIA,
Water and Power Resources Service, Sacramento, CA.
N. P. Prokopovich.
Bulletin of the Association of Engineering Geologists, Vol 19, No 4, p 427-432, November, 1982. 9 Fig, 2 Ref.

Descriptors: *Dams, *Maintenance, *Rocks, Reservoirs, Construction, Cleanup, Earth dams, Concrete technology, Stilling basins, Folsom Dam, *California, Spillways.

Peculiar, nearly spherical balls composed of hard, igneous and metamorphic rock types were found in scattered debris in concrete-lined stilling basins of Folsom and several other dams in California. Ball formation is the result of rock abrasion under extremely turbulent flow conditions in an entrapment container and is associated with an undesirable erosion of container concrete lining. Proper design of basins, post-construction cleanup and protection from rock-throwing by visitors can eliminate formation of rock balls and reduce erosion of the lining. It is equally important to prevent rock falls on air-exposed slopes above basins and to remove loose debris which might be backwashed from river channel immediately downstream of stilling basins. At the Folsom Dam, on the American River in California, an earthfill structure with a 427 m long and 104 m high concrete gravity channel spillway section, rock balls caused intense erosion of the stilling-basin lining, with exposure of steel reinforcing bars. Repeated dewatering of the stilling basin for cleanup and repair was required. (Baker-FRC)
W83-02661

CONCRETE WATERWAY LININGS FOR THE DRAKENSBERG PUMPED STORAGE SCHEME,
Gibb, Hawkins and Partners, London (England).
M. T. Eastwood, and M. J. de Witt.
Civil Engineer in South Africa, Vol 24, No 8, p 435-437, 439-441, 443-445, 447, August, 1982. 8 Fig, 10 Ref.

Descriptors: *Linings, *Tunnel linings, *Underground structures, Concrete technology, Drakensberg Pumped Storage Scheme, *South Africa, Conduits, Water conveyance, Pressure conduits, Grouting, Pumped storage.

The Drakensberg Pumped Storage Scheme, South Africa, includes 8.5 km of croncrete-lined waterways and 1 km of steel-lined waterways and 1 km of steel-lined penstocks. Unreinforced concrete linings were chosen for the low pressure conduits. However, in the most degradable mudstones linings were backed with membranes. High pressure linings were prestressed by contact grouting. This process produced an elastic rock/concrete structure, which was suitable for the anticipated range of loading. Techniques used to achieve this high degree of stressing are described in detail. In areas of low overburden stress subject to hydrofracturing, steel linings were used. (Cassar-FRC)
W83-02668

8G. Materials

IMPROVING THE SPEED OF SHOTCRETE SETTING,
International Water Power and Dam Construction, Vol 34, No 4, p 35-37, April, 1982. 8 Fig.

Descriptors: *Sealants, *Construction materials, *Cements, Maintenance, Tunnel construction, Tunnels, Strength, *Shotcrete, Aggregates.

Shotcrete is a versatile material which may be used to coat tanks and pipes and repair tunnels and swimming pools. Shotcrete dries fast enough to render true early support. It can be used for repair in tidal zones directly in front of a rising tide. New accelerators for shotcrete contain no caustics or chlorides. With these new accelerators, initial set at 3% dosage was 1 minute 30 seconds and final set was 2 minutes 5 seconds. Strengths obtained with the new accelerator were over 2800 pounds/sq inch at 8 hr. The new noncaustic accelerator scored low in tests for skin and eye irritation. Factors affecting dry-process shotcrete are effective water content, prehydration, and experience of the personnel using it. Accelerated shotcrete is used where early support of a tunnel is needed, where a thick layer of shotcrete is required and where the sealing off of running water is required. (Geiger-FRC)
W83-02537

NORWEGIAN PRACTICE IN INSTRUMENTING DAMS,
State Power System, Oslo (Norway).
K. Y. Nilsen, E. DiBiagio, and A. Andresen.
International Water Power and Dam Construction, Vol 34, No 11, p 34-38, 1982. 7 Fig, 7 Ref.

Descriptors: *Dam construction, *Rockfill dams, *Earth dams, *Safety, *Measuring instruments, Dam stability, Concrete dams, Dams, Dam design, Embankments, Data acquisition, Leakage, Deformation.

The Norwegian Code of Practice for Dams requires that provisions be made for monitoring dam performance. However, except for measurements of seepage and deformation, the Code does not specify what aspects should be monitored. Relatively few earth and rockfill dams have been built in Norway in recent years. Dams in Norway are owned and operated by private, semi-private, or national companies. A department within the Norwegian Water resources and Electricity Board is charged with the supervision and regulation of dams. According to 1965 guidelines, a public warning system should be set up in each dam to monitor leakage and water level. Routine instrumentation should allow measurements of seepage and deformations of the dam during construction and measurements of porewater pressure in the core material to verify that the embankment is being constructed at a safe rate. Instruments at the Svatevann dam are described as an example of the latest monitoring devices available for rockfill and concrete dams. The measurement of seepage, surface deformations, internal deformations, total earth pressure, and pore-water pressure is discussed. On larger dam monitoring projects, data are recorded automatically by small microprocessor-based data loggers. Measurements are usually continuous throughout the first two or three cycles of filling and drawdown of the reservoir, and then are decreased considerably afterwards. Seepage data are recorded continuously in the vicinity of the weirhouse on strip-chart recorders, and data is transmitted to the nearest power station control room. (Geiger-FRC)
W83-02630

INSPECTING, PAINTING, AND MAINTAINING STEEL WATER TANKS,
Harper and Associates, Inc., Riverside, CA.
W. B. Harper.
Journal of the American Water Works Association, Vol 74, No 11, p 585-587, November, 1982.

Descriptors: *Water tanks, *Maintenance, Inspection, Painting, Coatings, Water storage, Storage tanks.

Water tanks require periodic inspection for signs of deteriorating paint coatings and regular maintenance of exterior and interior finishes. Dark exterior colors appear to degenerate faster than lighter colors and also cause more problems with interior coatings because of solar heat absorption. Methods of inspection are described, as are procedures for repainting and recoating tanks. A well-planned program of inspection, painting, and maintenance is within reach of every water organization, as professional assistance is available from a variety of sources. Awareness of the problem and initiation of a plan of remedial action will lead to many years of trouble free operation of steel water tanks. (Baker-FRC)
W83-02713

8H. Rapid Excavation

PARAMETERS OF CANALS CONSTRUCTED BY THE CRATER BLASTING METHOD,
D. M. Kushnarev.
Hydrotechnical Construction, No 9, p 910-915, September, 1980. 5 Fig, 3 Tab, 9 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 9, p 20-24, September, 1980.

Descriptors: *Excavation, *Explosives, *Canal construction, Rapid excavation, Crater blasting, Blasting, Canal seepage, Seepage, Flow velocity, Erosion.

Field investigations of crater blasting of canals were carried out in sand, loam, and dense moraine clays under conditions of natural water content and in saturated soils. Blasting caused the fine clay particle content to increase in the upper horizons and decrease in the lower horizons. In noncohesive soils (sand) blasting did not change the physical and mechanical properties of the backfallen soil. In poorly cohesive and cohesive soils the backfallen material consisted of aggregates with high mechanical strength. The coefficients of friction immediately after blasting were 0.30-0.45 but decreased to 0.18-0.25 after siltation had decreased the roughness of the canal bed. Seepage and erosion were less in crater-blasted canals than in mechanically excavated canals. In a loam soil erosion was 4-5 times less in the blasted canal than in the dry canal. (Canal-FRC)
W83-02596

8I. Fisheries Engineering

COOLING SYSTEMS: CAN ENGINEERS SAVE THE FISH,
Burns and Roe, Inc., Oradell, NJ. Hydraulic Engineering Dept.
R. T. Richards.
Consulting Engineer (St. Joseph), Vol 59, No 5, p 58-64, November, 1982. 5 Fig.

Descriptors: *Cooling water, *Thermal discharges, *Fish conservation, Water cooling, Cooling towers, Cooling ponds, Thermal plumes, Thermal pollution, Thermal powerplants, Thermal water, Powerplants, Aquatic environment, Intakes, Screens, Entrainment, Protection, Fish barriers, Fish eggs, Fish guiding, Fish handling facilities, Fish passages, Water quality control.

The adverse effects of powerplant cooling systems on the aquatic environment can be mitigated by several engineering measures. Heated water leaving the cooling system may be recycled, routed to captive ponds or spray ponds for partial cooling prior to discharge, or treated by a combination of systems. Fish may be protected by recovery from the intake screens and return to a safe section of the waterway, by diversion using angled screens and louvers, by deterrents such as air bubble curtains and noise generators, by exclusion (very fine screens or a radial well system), by choosing an intake site away from areas of the screen faces, by using velocity caps, and by using cylindrical pipe intakes. Some typical discharge methods are low velocity (2 fps) canal discharge, low velocity diffuser discharge, single port low velocity (5-7 fps) discharge, single port high velocity (12-15 fps) discharge, and multiport (sometimes 50 ports) discharge. Discharge temperatures may be reduced by increasing the amount of water passing through the condenser or adding cool water to the hot discharge. Engineers must also consider the potential effects of a powerplant shutdown (which suddenly eliminates heated discharge from an adapted environment), minerals discharged by blowdown, construction of facilities, and dredging. (Cassar-FRC)
W83-02551

9. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES RESEARCH COORDINATION AND PLANNING IN THE COLORADO RIVER-GREAT BASIN REGION,
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-194126, Price codes: A05 in paper copy, A01 in microfiche.
Colorado Water Resources Research Institute Completion Report, Colorado State University,

Fort Collins, February 1983. 92 p, 2 Fig, 2 Tab, 3 Append. B-146-COLO(1), B-155-COLO(1), 14-31-0001-6064(1), 14-34-0001-7144(1).

Descriptors: *Planning, *Project planning, *Regional planning, *River basin development, Water resources development, *Colorado River-Great Basin region, *Water Research Institutes.

Summaries are presented of regional research planning and implementation activities carried on by the Consortium of Colorado River-Great Basin Water Institutes and Centers (CWIC) beginning in FY1973. At that time a regional research program was initiated in response to Congressional concerns over the need for research concerning water problems common to two or more states. Administrative funds were allocated to one Institute in each region for use in initiating this new program. The Colorado Institute was selected as the administrative manager for the Colorado River-Great Basin Region. Seven states are within that region, including Colorado, Wyoming, New Mexico, Utah, Nevada, Arizona, and California. The CWIC funding was allocated in Projects X-138, B-146-COLO, and B-155-COLO. Subcontracts were executed with each of the basin Institutes covering their participation. Active collaboration in identifying regional water problems and formulating the appropriate research approach to solving those of highest priority was established with the Pacific Southwest Interagency Committee (PSIAC). Consequently, the CWIC regional research program was intergrated into the PSIAC at the outset, and became a regular element of their activities. CWIC directors met quarterly with PSIAC at its regular meetings, giving progress reports and getting recommendations on specific research needs as well as priorities. This led to a very effective regional research program.
W83-02744

10. SCIENTIFIC AND TECHNICAL INFORMATION

PRECONCENTRATION METHODS FOR THE ANALYSIS OF WATER BY X-RAY SPECTROMETRIC TECHNIQUES,
Antwerp Univ., Wilrijk (Belgium). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W83-02654

10F. Preparation Of Reviews

DISTRIBUTION OF ACTINOMYCETES IN NATURAL WATERS (A SURVEY),
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5B.
W83-02624

THE ISOLATION OF BACTERIOPHAGES FROM THE ENVIRONMENT,
Searle and Co. Ltd., High Wycombe (England). Searle Research and Development.
For primary bibliographic entry see Field 5A.
W83-02708

SUBJECT INDEX

ACCUMULATION
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

ACETONE
Fate of Acetone in Water,
W83-02645 5B

ACID RAIN
Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

ACIDIC WATER
Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

ACIDIFICATION
Acidification of Groundwater in Norway,
W83-02793 2K

ACIDITY
Acidification of Aquatic Systems: A Critique of Chemical Approaches,
W83-02567 2K

ACTINIUM
Determination of Radium-228 in Foods and Water,
W83-02686 5A

ACTINOMYCETES
Distribution of Actinomycetes in Natural Waters (A Survey),
W83-02624 5B

ACTIVATED CARBON
Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

ACTIVATED CHAR
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

ACTIVATED SLUDGE PROCESS
Start-Up and Operation of an Oxygen-Activated Advance Wastewater Treatment System,
W83-02680 5D

Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

A New Configuration of the High-Lime Process with Sludge Recirculation for Magnesium Recycling,
W83-02751 5D

Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

Wastewater System Improvements Help Dallas Meet Future Needs,
W83-02771 5D

Application of the Marais - Ekama Activated Sludge Model to Large Plants,
W83-02791 5E

ADENOSINE TRIPHOSPHATE
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

ADSORPTION
Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

Fate of Acetone in Water,
W83-02645 5B

Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

The Isolation of Bacteriophages from the Environment,
W83-02708 5A

Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

ADU DHABI
Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

ADVANCED WASTEWATER TREATMENT
Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

Start-Up and Operation of an Oxygen-Activated Advance Wastewater Treatment System,
W83-02680 5D

A New Configuration of the High-Lime Process with Sludge Recirculation for Magnesium Recycling,
W83-02751 5D

ADVECTION
Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

AERATION
Thickening and Biological Disinfection of Wastewater Sludge by Submersed Rotation Aeration (Eindickung Und Biologische Entseuchung Von Abwasserschlamm Durch Submerse Umwalzbeluftung),
W83-02506 5D

Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

Further Action by the Cantons. Aargau Canton (Das Weitere Vorgehen Der Kantone. Kanton Aargau),
W83-02758 5G

Further Action by the Cantons. Lucerne Canton (Das Weitere Vorgehen Der Kantone. Kanton Luzern),
W83-02759 5G

AERATION DEVICES
Spillway Aeration of the San Roque Project,
W83-02540 8B

AEROBIC BACTERIA
The Populations, Characterization and Activity of Suspended Bacteria in the Welsh River Dee,
W83-02707 5B

AEROBIC CONDITIONS
A Process for the Biological Disinfection of Sludge (Ein Verfahren Zur Biologischen Hygienisierung Von Klarschlamm),
W83-02507 5D

AEROBIC THERMOPHILIC DIGESTION
Aerobic Thermophilic Digestion of Sewage Sludge,
W83-02568 5E

AFRICA
Seeking Consumers Cooperation in the Financing of Water Supply (Conditions Permettant Aux Consommateurs A Ressources Limitees De Participer Au Financement De Leur Consommation D Eau),
W83-02634 6C

AGRICULTURAL CHEMICALS
Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

AGRICULTURAL RUNOFF
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

AGRICULTURAL WASTES
Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

ALASKA
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

ALDICARB
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

ALFALFA
Analysis of Irrigation Pumping and Application Efficiency in Nevada,
W83-02499 3F

ALGAL ASSAY
Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

ALGAL CONTROL
Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

ALGAL GROWTH
The Microbial Dynamics of an Epilithic Algal-Bacterial Mat Community in an Oligotrophic, High Alpine Stream,
W83-02490 5B

Large-Scale Development of Cerataulina Bergonii Perag in the Northwestern Part of the Black Sea,
W83-02602 5C

ALGORITHMS
Analysis of a Finite Element Algorithm for Numerical Predictions in Water Resources Research,
W83-02656 8B

ALKALINE-RESISTANT RO MEMBRANES
Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

ALKALINITY
Acidification of Aquatic Systems: A Critique of Chemical Approaches,
W83-02567 2K

ALLUVIAL CHANNELS
Celerity of Transient Bed Profiles,
W83-02694 2J

Bed Characteristics in Alluvial Channel Bends,
W83-02698 2J

ALMOND ORCHARDS
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

ALTERNATIVE PLANNING
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

ALTERNATIVE USES
Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

ALUM
Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

ALUMINUM SULFATE
Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

AMAZON RIVER ESTUARY
Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

AMINO ACIDS
Interactions Between Amino-Acid-Degrading Bacteria and Methanogenic Bacteria in Anaerobic Digestion,
W83-02515 5D

AMMONIFICATION
Biological Nitrification in an Up Flow Fixed Bed Reactor (UFBR),
W83-02747 5D

ANADROMOUS FISH
Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

ANAEROBIC BACTERIA
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

ANAEROBIC CONDITIONS
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

ANAEROBIC DIGESTION
Interactions Between Amino-Acid-Degrading Bacteria and Methanogenic Bacteria in Anaerobic Digestion,
W83-02515 5D

ANALYSIS OF VARIANCE
Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

ANHYDROUS AMMONIA
Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

ANIMAL WASTES
Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

Halting Creek Pollution,
W83-02768 5B

Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

ANION EXCHANGE
The Degree of Utilization of Anion Exchange Filters in Nitrate Removal From Drinking Water (Ausnutzungsgrad Von Anionenaustauschfiltern Bei Der Nitratentfernung Aus Trinkwassern),
W83-02512 5F

ANODIC OXIDATION
Anodic Oxidation for Drinking Water Disinfection, Part 1: Bacteriologic Studies in Practical Use (Anodische Oxydation Trinkwasserdesinfektion, 1. Mitteilug: Bakteriologische Untersuchungen Bei Praxiseinsatz),
W83-02588 5F

ANTHRACENE
Uptake, Depuration and Biotransformation of Anthracene by the Scud Pontoporeia Hoyi,
W83-02549 5B

AQUACULTURE
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

Engineers Assess Aquaculture Systems For Wastewater Treatment - Part II,
W83-02649 5D

AQUATIC ANIMALS
Aquatic Invaders,
W83-02766 5F

AQUATIC LIFE
Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

AQUATIC PLANT CONTROL
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

AQUATIC PRODUCTIVITY
Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

AQUATIC WEEDS
Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

AQUIFER
Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

AQUIFER CHARACTERISTICS
Symposium on Surface Coal Mining and Reclamation in the Northern Great Plains, an Update on Mine Spoils Hydrology Southeastern Montana,
W83-02495 2F

Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

Application of the Aquifer's Average Characteristics for Determining the Onset of Thermohaline Convection in a Heterogeneous Aquifer,
W83-02674 2F

Thermohaline Convection in a Nonhomogeneous Aquifer,
W83-02675 2F

Well Hydraulics in Vertically Heterogeneous Formations,
W83-02693 2F

ARIZONA
Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

AROMATIC COMPOUNDS
Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

ARSENIC
Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

ARTIFICIAL RECHARGE
Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

ASCORBIC ACID
Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

ASPEN
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

ASYMMETRIC (ANISOTROPIC) MEMBRANES
Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

ATOMIC ABSORPTION SPECTROPHOTOMETRY
Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

ATTITUDES
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

AUSTRALIA
Instrumenting Australia's Cethana Dam,
W83-02603 8A

Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

AUTOREGRESSIVE MODELS
Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

BACKWASH
Direct Filtration: Polymer in Backwash Serves Dual Purpose,
W83-02683 5D

BACTERIA
Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

Interactions Between Amino-Acid-Degrading Bacteria and Methanogenic Bacteria in Anaerobic Digestion,
W83-02515 5D

Comparative Seasonal Uptake of Glucose and Acetate by Epiphytic Bacteria on the Surfaces of Three Species of Macrophyte in the Littoral Zone of Lake Ohrid, Yugoslavia,
W83-02556 2H

Anodic Oxidation for Drinking Water Disinfection, Part 1: Bacteriologic Studies in Practical Use (Anodische Oxydation Trinkwasserdesinfektion, 1. Mitteilug: Bakteriologische Untersuchungen Bei Praxiseinsatz),
W83-02588 5F

Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

Distribution of Actinomycetes in Natural Waters (A Survey),
W83-02624 5B

Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

Superbugs: Bacteria for Wastewater Treatment Plants,
W83-02769 5D

BACTERIAL ANALYSIS
Estimation of the Sewage Loading of the Mediterranean at the Beaches of Valencia, Spain (Estimacion de la Carga Contaminante Vertida al Mar Mediterraneo en el Litoral Proximo a la Ciudad de Valencia (Espana)),
W83-02796 5B

BACTERIOPHAGE
The Isolation of Bacteriophages from the Environment,
W83-02708 5A

BANKS
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

BASIN CHARACTERISTICS
Remote Sensing Determination of Hydrograph Recession Characteristics,
W83-02487 2A

BEAULIEU RIVER
Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

BED LOAD
Saltation in Water Dynamics,
W83-02679 8B

Celerity of Transient Bed Profiles,
W83-02694 2J

Lateral Bed Load Transport on Side Slopes,
W83-02709 8B

BEDROCK
Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

BELGIUM
Formation and Removal of Mutagenic Activity in Drinking Water by Ozonisation,
W83-02510 5F

BENTHIC ENVIRONMENT
Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

BENTHOS
Prediction of Effects of Daily Flow Fluctuations on Stream Biota,
W83-02480 6G

BENTONITE
The Role of Bentonite in Soil Sealing Applications,
W83-02662 5G

BIGHTS STUDIES
Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

BIOACCUMULATION
PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

Uptake, Depuration and Biotransformation of Anthracene by the Scud Pontoporeia Hoyi,
W83-02549 5B

BIOASSAY
Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

BIOCHEMICAL OXYGEN DEMAND
Practical Determination of the First Stage BOD of Sewage,
W83-02581 5A

BIODEGRADATION
Acclimation to and Biodegradation of Nitrilotriacetate (NTA) at Trace Concentrations in Natural Waters,
W83-02461 5B

Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

BIODEGRATION
Fate of Acetone in Water,
W83-02645 5B

BIOFILMS
Effect of Denitrification on the pH in Biofilms,
W83-02752 5D

Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

BIOINDICATORS
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

BIOLOGICAL ACTIVATED CARBON FILTERS
Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

BIOLOGICAL SAMPLING
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

BIOLOGICAL TREATMENT
A Process for the Biological Disinfection of Sludge (Ein Verfahren Zur Biologischen Hygienisierung Von Klarschlamm),
W83-02507 5D

Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

Superbugs: Bacteria for Wastewater Treatment Plants,
W83-02769 5D

BIOLOGICAL WASTEWATER TREATMENT
Thickening and Biological Disinfection of Wastewater Sludge by Submersed Rotation Aeration (Eindickung Und Biologische Entseuchung Von Abwasserschlamm Durch Submerse Umwalzbeluftung),
W83-02506 5D

The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

The Scale-Up and Limitation of Physical Oxygen Transfer in Rotating Biological Contactors,
W83-02750 5D

BIOTRANSFORMATION
Uptake, Depuration and Biotransformation of Anthracene by the Scud Pontoporeia Hoyi,
W83-02549 5B

BLACK SEA
Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

Large-Scale Development of Cerataulina Bergonii Perag in the Northwestern Part of the Black Sea,
W83-02602 5C

BLEACHING
The Effect of Chlorine Dioxide Substitution in the First Stage of Pulp Bleaching on Bleach Plant Effluent BOD,
W83-02469 5D

BORON
Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

BOTTOM SEDIMENTS
Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

BOUNDARY CONDITIONS
Boundary Methods in Water Resources,
W83-02655 8A

BOUNDARY LAYERS
Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

BOUNDARY METHODS
Boundary Methods in Water Resources,
W83-02655 8A

BRACKISH WATERS
Continuous Countercurrent Ion Exchange for Desalination and Tertiary Treatment of Effluents and Other Brackish Waters,
W83-02792 3A

BRAZIL
Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

Building A Hydro Station in a Narrow Gorge,
W83-02543 8A

BRIDGES
Overflow Road Crossing Across the Dnestr River at the Construction Site of the Dnestr Hydrostation,
W83-02594 8A

BULB TURBINES
Experience Curves for Feasibility Studies and Planning of Modern Low-Head Hydro Turbines,
W83-02489 8C

BULGARIA
Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

BUTTERFLY VALVES
Project Studies and Research Work Concerning Butterfly Valves as Used in Water Power Stations and Retarding Basins (Planungskriterien Und Forschung Bei Drosselklappen Fur Kraftwerksanlagen Und Ruckhaltebecken),
W83-02761 8C

CADDISFLIES
Prediction of Effects of Daily Flow Fluctuations on Stream Biota,
W83-02480 6G

CADMIUM
Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

CALCIUM CARBONATE
Kinetic Fractionation of Carbon-13 During Calcium Carbonate Precipitation,
W83-02570 2K

CALIFORNIA
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

Sludge Disposal in Southern California Basins,
W83-02527 5E

Hydro-Fracturing at Helms,
W83-02539 8A

Initial Sedimentation of Waste Particulates Discharged From Ocean Outfalls,
W83-02565 5B

Rock Balls at Folsom Dam, California,
W83-02661 8F

Seismic Safety Analysis of Lower Crystal Springs Dam: A Case History,
W83-02663 8E

Flow Computation Using Extrapolation Procedures,
W83-02695 2E

Bed Characteristics in Alluvial Channel Bends,
W83-02698 2J

Toxic Substances Monitoring Program - 1981,
W83-02719 5A

Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

CANADA
Evaluation of Organochlorine Contents in the Saint Lawrence River, Estuary and Gulf, Canada (Evaluation Des Teneurs En Composes Organochlores Dans Le Fleuve, L'Estuaire Et Le Golfe Saint-Laurent, Canada),
W83-02578 5B

Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

CANAL CONSTRUCTION
Parameters of Canals Constructed by the Crater Blasting Method,
W83-02596 8H

CANALS
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

CANYONS
Building A Hydro Station in a Narrow Gorge,
W83-02543 8A

CARBAMATE PESTICIDES
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

CARBON
Kinetic Fractionation of Carbon-13 During Calcium Carbonate Precipitation,
W83-02570 2K

CARBON DIOXIDE
Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

CARBON FIXATION
Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

CARBON ISOTOPES
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

CARCINOGENS
Detection of Potential Carcinogens and Toxicants in Tap and Reclaimed Water by the Golden Hamster Cell Transformation Assay,
W83-02460 5A

CATCHMENT AREAS
The Hundred-Year Effort to Secure Hong Kong's Water Supply (Hundertjahriges Bemuhen um Hong Kong's Wasserversorgung),
W83-02762 3B

CAVITATION
Spillway Aeration of the San Roque Project,
W83-02540 8B

CEMENTS
Improving the Speed of Shotcrete Setting,
W83-02537 8G

CERCARIAL CONTROL
Slow Sand Filtration for Cercarial Control in North Cameroon Village Water Supply,
W83-02790 5F

CESIUM
90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

CHELATING AGENTS
Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

CHEMICAL ANALYSIS
Acidification of Aquatic Systems: A Critique of Chemical Approaches,
W83-02567 2K

Evaluation of Organochlorine Contents in the Saint Lawrence River, Estuary and Gulf, Canada (Evaluation Des Teneurs En Composes Organochlores Dans Le Fleuve, L'Estuaire Et Le Golfe Saint-Laurent, Canada),
W83-02578 5B

Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

Estimation of the Sewage Loading of the Mediterranean at the Beaches of Valencia, Spain (Estimacion de la Carga Contaminante Vertida al Mar Mediterraneo en el Litoral Proximo a la Ciudad de Valencia (Espana)),
W83-02796 5B

CHEMICAL DEGRADATION
The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

CHEMICAL PROPERTIES
Acidification of Groundwater in Norway,
W83-02793 2K

CHEMICAL REACTIONS
Salting-Out of Methane in Single-Salt Solutions at 25 Degrees C and Below 800 PSIA,
W83-02583 2K

Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

Acid-Base Equilibrium During Photosynthesis in Water,
W83-02600 2K

CHEMICAL WASTES
Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

CHEMICAL WASTEWATER
Electroflotation Purifies Chemical Wastewater (Elektroflotation Reinigt Chemieabwasser),
W83-02508 5D

Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

Treatment of Unusual Inorganic Wastes,
W83-02580 5D

CHEMICALS
Water Chemicals Codex,
W83-02546 5F

CHEMISTRY OF PRECIPITATION
Kinetic Fractionation of Carbon-13 During Calcium Carbonate Precipitation,
W83-02570 2K

CHINA
Technology--What is it For. Two Examples from the More Than 2,000-Year History of Hydraulic Engineering in China (Technik Wozu. Zwei Beispiele Aus Der Uber 2000Jahrigen Geschichte Des Wasserbaues in China),
W83-02760 8A

CHLORAMINE
Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

CHLORELLA
Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

CHLORINATED COMPOUNDS
Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

CHLORINATED HYDROCARBONS
Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

CHLORINATION
Formation and Removal of Mutagenic Activity in Drinking Water by Ozonisation,
W83-02510 5F

Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

CHLORINE DIOXIDE
The Effect of Chlorine Dioxide Substitution in the First Stage of Pulp Bleaching on Bleach Plant Effluent BOD,
W83-02469 5D

Measuring Chlorine Dioxide With a Rotating Voltammetric Membrane Electrode.
W83-02682 5A

CHLORINE-RESISTANT RO MEMBRANES
Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

CHLOROANILINE
Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

CHROMATOGRAPHY
Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

CHROMIUM
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

CLADOCERAN
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

CLARIFICATION
Obtaining Secondary Treatment with RBC/Underflow Clarifiers,
W83-02753 5D

CLASSIFICATION
The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

CLAYS
Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

CLIMATOLOGY
Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

COAGULANTS
Survey of Polyelectrolyte Coagulant Use in the United States,
W83-02691 5F

COAGULATION
Technical Note: Removing Trihalomethane Formation Potential by Coagulation With Activated Silica and Cationic Polymer,
W83-02681 5F

COAL
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

COAL GASIFICATION
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

COAL LIQUEFACTION
Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

COAL MINING
Symposium on Surface Coal Mining and Reclamation in the Northern Great Plains, an Update on Mine Spoils Hydrology Southeastern Montana,
W83-02495 2F

COASTAL WATERS
Contamination of the Mediterranean Coast and its Control as a Problem of Land Management (La Contaminacion Litoral Mediterranea Y su Correccion Como un Problema De La Ordenacion Territorial),
W83-02777 5B

Estimation of the Sewage Loading of the Mediterranean at the Beaches of Valencia, Spain (Estimacion de la Carga Contaminante Vertida al Mar Mediterraneo en el Litoral Proximo a la Ciudad de Valencia (Espana)),
W83-02796 5B

COASTAL ZONE MANAGEMENT
Land-Use and Management Problems in the Nile Delta,
W83-02462 6G

Contamination of the Mediterranean Coast and its Control as a Problem of Land Management (La Contaminacion Litoral Mediterranea Y su Correccion Como un Problema De La Ordenacion Territorial),
W83-02777 5B

COCRYSTALLIZATION
Energy Aspects of Equilibrium Cocrystallization From Aqueous Solution,
W83-02585 2K

COLIFORMS
Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

Halting Creek Pollution,
W83-02768 5B

COLORADO
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

COLORADO RIVER BASIN
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

COLORADO RIVER-GREAT BASIN REGION
Water Resources Research Coordination and Planning in the Colorado River-Great Basin Region,
W83-02744 9D

COLUMBIA RIVER ESTUARY
The Crest Dispute: A Mediation Success,
W83-02532 6D

COMMUNITY FUNCTION
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

COMMUNITY WATER CONSERVATION
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

COMPETING USE
Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

COMPUTER MODELS
Design and Analysis of Urban Storm Drainage - The Wallingford Procedure,
W83-02550 2A

SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

COMPUTERS
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

Computer-Based Telemetry Monitors Water Use,
W83-02794 5F

Computer Assisted Analysis to Improve Water System Operation,
W83-02799 5F

CONCRETE DAMS
Current Requirements Imposed on the Contact of Gravity and Buttress Dams with Rock Foundations,
W83-02595 8E

Instrumenting Australia's Cethana Dam,
W83-02603 8A

Safety Monitoring of Concrete Dams,
W83-02632 8F

CONDENSERS
Operation of Meff Desalination Plant (Multiple Effect Falling Film Process),
W83-02525 3A

CONDUCTIVITY
Diurnal Variations in Electrical Conductivity of Water in a Small Stream,
W83-02776 2K

CONIFERS
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

CONNECTICUT
Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

CONNECTICUT RIVER BASIN
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

CONSTRUCTION
The Expansion of the Uster Wastewater Treatment Facility--Fourth Treatment Stage--Wastewater Filtration Facility (Die Erweiterung Der Klaranlage Uster, 4. Reinigungsstuffe, Abwasswerfiltrationsanlage).
W83-02503 5D

Overflow Road Crossing Across the Dnestr River at the Construction Site of the Dnestr Hydrostation,
W83-02594 8A

Modeling of Watercourse CLosure (Modelisation de Fermeture des Cours D'Eau),
W83-02614 8B

Cubelles Thermal Power Plant-A New Solution for the Intake and Discharge of Cooling Water (Centra Termica De Cubelles-Una Nueva Solucion Para la Toma Y Descarga de Agua de Refrigeracion),
W83-02795 8A

CONSTRUCTION MATERIALS
Improving the Speed of Shotcrete Setting,
W83-02537 8G

CONSUMPTIVE USE
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

CONTINENTAL SHELF
Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

CONTROL SYSTEMS
Computer-Based Telemetry Monitors Water Use,
W83-02794 5F

CONVECTION
Thermohaline Convection in a Nonhomogeneous Aquifer,
W83-02675 2F

COOLING WATER
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

Cooling Systems: Can Engineers Save the Fish,
W83-02551 8I

Cubelles Thermal Power Plant-A New Solution for the Intake and Discharge of Cooling Water (Centra Termica De Cubelles-Una Nueva Solucion Para la Toma Y Descarga de Agua de Refrigeracion),
W83-02795 8A

COPPER
Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

CORN
Modeling Sediment Deposition Behind Corn Residue,
W83-02455 4D

CORROSION
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

COST-BENEFIT ANALYSIS
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

COSTS
Further Action by the Cantons. Lucerne Canton (Das Weitere Vorgehen Der Kantone. Kanton Luzern),
W83-02759 5G

COTTON
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

Cotton Growth Related to Plant's Water Status,
W83-02576 3F

COWLITZ RIVER
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

CROP PRODUCTION
Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

CROP WATER USE
Weekly Water Use Estimates by Crops and Natural Vegetation in Indiana,
W83-02739 2D

CROP YIELD
A Model for Drainage Benefits,
W83-02452 4A

The Adaptation of Varieties of Sorghum to Different Water Regimes,
W83-02612 2I

CROPS
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

CRYSTALLIZATION
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

CULTURE MEDIA
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

CULTURING TECHNIQUES
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

CYANOPHYTA
Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

CZECHOSLOVAKIA
Czechoslovakia's Largest Pumped-Storage Plant,
W83-02542 8A

DAM CONSTRUCTION
Building A Hydro Station in a Narrow Gorge,
W83-02543 8A

Instrumenting Australia's Cethana Dam,
W83-02603 8A

Monitoring Dams and Their Foundations,
W83-02629 8D

Norwegian Practice in Instrumenting Dams,
W83-02630 8G

The Construction of the Tugela-Vaal Project Dams,
W83-02643 8A

The Dams of the Tugela-Vaal Project,
W83-02648 8A

DAM DESIGN
Building A Hydro Station in a Narrow Gorge,
W83-02543 8A

Embankment Dams of Paz Cascade of Hydropower Stations and Some Conclusions From Their Operational Experience,
W83-02593 8E

DAM FAILURE
Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

DAM FOUNDATIONS
Current Requirements Imposed on the Contact of Gravity and Buttress Dams with Rock Foundations,
W83-02595 8E

Instrumenting Australia's Cethana Dam,
W83-02603 8A

Monitoring Dams and Their Foundations,
W83-02629 8D

DAM STABILITY
Instrumenting Australia's Cethana Dam,
W83-02603 8A

Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

Monitoring Dams and Their Foundations,
W83-02629 8D

Safety Monitoring of Concrete Dams,
W83-02632 8F

DAMS
Modeling of Watercourse CLosure (Modelisation de Fermeture des Cours D'Eau),
W83-02614 8B

The Drakensberg Project: Water and Power for South Africa,
W83-02647 6D

Rock Balls at Folsom Dam, California,
W83-02661 8F

Seismic Safety Analysis of Lower Crystal Springs Dam: A Case History,
W83-02663 8E

Inspection and Maintenance of Dam Dewatering Facilities,
W83-02770 8C

DATA ACQUISITION
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

DATA COLLECTIONS
Monitoring Dams and Their Foundations,
W83-02629 8D

Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

DATA STORAGE AND RETRIEVAL
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

DDD
PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

DDE
PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

DDT
PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

DEAD SEA
Physico-Chemical Study of Dead Sea Water, II. Density Measurements and Equation of State of Dead Sea Water at 1 ATM,
W83-02464 2H

DECOMPOSING ORGANIC MATTER
The Influence of Kokanee Salmon and Man on the Water Quality of Lower McDonald Creek, Glacier National Park, Montana,
W83-02494 5C

DECOMPOSITION
Decomposition of Ozone in Water: Rate of Initiation by Hydroxide Ions and Hydrogen Peroxide,
W83-02577 5F

Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

DEFLECTION
Instrumenting Australia's Cethana Dam,
W83-02603 8A

DEGRADATION
The EPA-Test – A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

Fate of Acetone in Water,
W83-02645 5B

DELAWARE
Effluent Limitations Based on Water Quality,
W83-02466 5E

DELTAS
Land-Use and Management Problems in the Nile Delta,
W83-02462 6G

Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

DEMINERALIZATION
Continuous Countercurrent Ion Exchange for Desalination and Tertiary Treatment of Effluents and Other Brackish Waters,
W83-02792 3A

DENITRIFICATION
Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

Effect of Denitrification on the pH in Biofilms,
W83-02752 5D

DENSITY
Physico-Chemical Study of Dead Sea Water, II. Density Measurements and Equation of State of Dead Sea Water at 1 ATM,
W83-02464 2H

DEPOSITION
Deposition of Sediments on Thicket-Covered Flood Plain,
W83-02605 2J

DESALINATION
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

Operation of Meff Desalination Plant (Multiple Effect Falling Film Process),
W83-02525 3A

Mathematical Model of a Mechanical Vapour Compression Evaporator. Application to Seawater Desalting. Part I-The Model Settlement,
W83-02526 3A

World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

Characterization of Fouling Potential for Pressure-Driven Membrane Processes: A New Simulated Flow Cell,
W83-02745 3A

Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

Continuous Countercurrent Ion Exchange for Desalination and Tertiary Treatment of Effluents and Other Brackish Waters,
W83-02792 3A

DESALINATION PLANTS
Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

Operation of Meff Desalination Plant (Multiple Effect Falling Film Process),
W83-02525 3A

Mathematical Model of a Mechanical Vapour Compression Evaporator. Application to

DESALINATION PLANTS

Seawater Desalting. Part I-The Model Settlement,
W83-02526 3A

World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

DESIGN
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

DESIGN CRITERIA
Building A Hydro Station in a Narrow Gorge,
W83-02543 8A

The Drakensberg Pumped Storage Scheme Description of Scheme and Principal Data,
W83-02671 8A

Designing and Installing Large Steel Water Mains to Prevent Failures,
W83-02710 5F

Project Studies and Research Work Concerning Butterfly Valves as Used in Water Power Stations and Retarding Basins (Planungskriterien Und Forschung Bei Drosselklappen Fur Kraftwerksanlagen Und Ruckhaltebecken),
W83-02761 8C

Keeping Clean Water Clean,
W83-02780 5F

DESTRATIFICATION
Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

DETERGENTS
Acclimation to and Biodegradation of Nitrilotriacetate (NTA) at Trace Concentrations in Natural Waters,
W83-02461 5B

DETRITUS
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

DEUTERIUM
Oxygen-18 and Deuterium Determination on a Single Water Sample of a Few Milligrams,
W83-02651 1A

DEVELOPING COUNTRIES
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

DIFFERENTIAL EQUATIONS
Improvement of the Accuracy of Prediction of Stochastic Models of the Oxygen Concentration in Running Waters (Verbessrung der Vorhersagegenauigkeit Stochastischer Modelle des Sauerstoffgehaltes von Fliessgewassern),
W83-02658 2E

DIFFUSION COEFFICIENT
Mass-Transfer Characteristics Within Microbial Systems,
W83-02749 5D

DIFFUSION LAYER THICKNESS
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

DISINFECTANTS
Hemoglobin-Glutathione Relationships in Trout Erythrocytes Treated With Monochloramine,
W83-02660 5C

DISINFECTION
Wastewater Sludge Disinfection With Gamma-Rays: An Overview (Klarschlammhygienisierung Mit Gamma-Strahlen: Ein Uberblick),
W83-02505 5D

Thickening and Biological Disinfection of Wastewater Sludge by Submersed Rotation Aeration (Eindickung Und Biologische Entseuchung Von Abwasserschlamm Durch Submerse Umwalzbeluftung),
W83-02506 5D

A Process for the Biological Disinfection of Sludge (Ein Verfahren Zur Biologischen Hygienisierung Von Klarschlamm),
W83-02507 5D

A Small Facility for the Ozone Treatment of Water (Kleinanlage Zur Ozonbehandlung Von Wasser),
W83-02509 5F

Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

Anodic Oxidation for Drinking Water Disinfection, Part II: Studies on Haloform Formation (Anodische Oxidation Zur Trinkwasserdesinfektion, II. Mitteilung: Untersuchungen Zur Haloformbildung),
W83-02589 5F

Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

DISPERSION
Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

DISSOLVED OXYGEN
Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

DISSOLVED SALTS
Salting-Out of Methane in Single-Salt Solutions at 25 Degrees C and Below 800 PSIA,
W83-02583 2K

DISTRIBUTION
Use of the Extremal-3 Distribution in Precipitation Evaluation and Low Water Analysis (Die Anwendung Der Extremal-3-Verteilung Bei Der Regenauswertung Und Der Niedrigwasseranalyse),
W83-02590 2B

DRAINAGE
A Model for Drainage Benefits,
W83-02452 4A

Embankment Dams of Paz Cascade of Hydropower Stations and Some Conclusions From Their Operational Experience,
W83-02593 8E

Effect of Subterranean Drainage on Some Properties of Clay Soils in Quebec (Effet du Drainage Souterrain Sur Quelques Proprietes de Sols Argileux du Quebec),
W83-02613 2G

DRAINAGE BASINS
Areal Differentiation of Land and Lake Snowcover in a Small Sub-Arctic Drainage Basin,
W83-02775 2C

Diurnal Variations in Electrical Conductivity of Water in a Small Stream,
W83-02776 2K

DRAINAGE COEFFICIENT
Drainage Coefficients,
W83-02454 4A

DRINKING WATER
A Small Facility for the Ozone Treatment of Water (Kleinanlage Zur Ozonbehandlung Von Wasser),
W83-02509 5F

The Degree of Utilization of Anion Exchange Filters in Nitrate Removal From Drinking Water (Ausnutzungsgrad Von Anionenaustauschfiltern Bei Der Nitratentfernung Aus Trinkwassern),
W83-02512 5F

Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

Decomposition of Ozone in Water: Rate of Initiation by Hydroxide Ions and Hydrogen Peroxide,
W83-02577 5F

Anodic Oxidation for Drinking Water Disinfection, Part 1: Bacteriologic Studies in Practical Use (Anodische Oxydation Trinkwasserdesinfektion, 1. Mitteilug: Bakteriologische Untersuchungen Bei Praxiseinsatz),
W83-02588 5F

Anodic Oxidation for Drinking Water Disinfection, Part II: Studies on Haloform Formation (Anodische Oxidation Zur Trinkwasserdesinfektion, II. Mitteilung: Untersuchungen Zur Haloformbildung),
W83-02589 5F

The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

Pollution of Drinking Water With Nitrate,
W83-02646 5B

Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

Slow Sand Filtration for Cercarial Control in North Cameroon Village Water Supply,
W83-02790 5F

DRIP IRRIGATION
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

DROUGHT
The Adaptation of Varieties of Sorghum to Different Water Regimes,
W83-02612 2I

DYES
Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

EARTH DAMS
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

Embankment Dams of Paz Cascade of Hydropower Stations and Some Conclusions From Their Operational Experience,
W83-02593 8E

Norwegian Practice in Instrumenting Dams,
W83-02630 8G

EARTHQUAKES
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

Seismic Safety Analysis of Lower Crystal Springs Dam: A Case History,
W83-02663 8E

ECONOMIC ASPECTS
The Economic Efficiency of Flood Plain Development,
W83-02477 6F

Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

ECONOMIC FACTORS
Economics of Precipitant Use in Municipal Wastewater Treatment Plants (Wirtschaftlichkeit Des Fallmitteleinsatzes in Kommunalen Klaranlagen),
W83-02591 5D

ECOSYSTEMS
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

Hydroelectric Power Utilization and Environmental Protection (Wasserkraftnutzung Und Umweltschutz),
W83-02788 6G

EDTA
Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

EFFLUENT CHARGES
Make Applications According to the State Wastewater Tax Laws on Time (Die Antrage Nach Den Landes-Abwasserabgabengesetzen Rechtzeitig Stellen),
W83-02786 6E

EFFLUENT LIMITATIONS
Effluent Limitations Based on Water Quality,
W83-02466 5E

EFFLUENTS
The Effect of Chlorine Dioxide Substitution in the First Stage of Pulp Bleaching on Bleach Plant Effluent BOD,
W83-02469 5D

Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

EGYPT
Land-Use and Management Problems in the Nile Delta,
W83-02462 6G

ELECTRIC POWER
World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

ELECTRODES
The Potentiometric Titration of Sulfide in Wastewater Using A Sensitive Electrode (Die Potentiometrische Titration Von Sulfid in Abwasser Mit Hilfe Einer Sensitiven Elektrode),
W83-02639 5A

ELECTRODIALYSIS
Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

ELECTROFLOTATION
Electroflotation Purifies Chemical Wastewater (Elektroflotation Reinigt Chemieabwasser),
W83-02508 5D

ELECTRONIC EQUIPMENT
Automatic Tensiometer Scanner for Rapid Measurements,
W83-02458 7B

ENERGY
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

Energy Aspects of Equilibrium Cocrystallization From Aqueous Solution,
W83-02585 2K

ENERGY SOURCES
Valles Caldera Geothermal Systems, New Mexico, U.S.A.,
W83-02701 2F

ENGERGY SAVINGS
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

ENGLAND
Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

Quantifying Source Areas Through Land Surface Curvature and Shape,
W83-02702 2E

ENTERIC BACTERIA
Parameters of Deteriorating Microbiological Quality of Selected Surface Waters in Residential Missoula, Montana,
W83-02492 5B

ENVIRONMENTAL EFFECTS
Land-Use and Management Problems in the Nile Delta,
W83-02462 6G

Sludge Disposal in Southern California Basins,
W83-02527 5E

Interaction of Large Hydraulic Engineering Systems with the Environment,
W83-02606 6G

Ecological Foundations of Measures to Protect the Hydrosphere Against Man-Made Pollution,
W83-02626 6G

Biomass of Marine Macrofauna Communities in a Dumping Area of Sewage Sludge Near the Elbe Estuary (Die Biomasse Mariner Makrobenthos-Gesellschaften im Bemundung),
W83-02627 5C

Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

Hydroelectric Power Utilization and Environmental Protection (Wasserkraftnutzung Und Umweltschutz),
W83-02788 6G

ENVIRONMENTAL ENGINEERING
Environmental Considerations of the Drakensberg Pumped Storage Scheme,
W83-02664 6G

ENVIRONMENTAL PROTECTION
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

ENVIRONMENTAL QUALITY
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

EPIPHYTES
Comparative Seasonal Uptake of Glucose and Acetate by Epiphytic Bacteria on the Surfaces of Three Species of Macrophyte in the Littoral Zone of Lake Ohrid, Yugoslavia,
W83-02556 2H

EQUILIBRIUM
Energy Aspects of Equilibrium Cocrystallization From Aqueous Solution,
W83-02585 2K

Theory of Hydrothermal Equilibria of Minerals of Variable Composition,
W83-02586 2K

EROSION CONTROL
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

Modeling Sediment Deposition Behind Corn Residue,
W83-02455 4D

Gully Control: Determining Treatment Priorities for Gullies in a Network,
W83-02544 4D

Bed Characteristics in Alluvial Channel Bends,
W83-02698 2J

Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

ESTUARIES
Behavior of Uranium in Two Estuaries of the Southeastern United States,
W83-02465 2L

Tidal Wave Analysis for Estuaries with Intertidal Flats,
W83-02637 2L

ESTUARINE ENVIRONMENT
Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

EUTROPHIC LAKES
The Rotsee - An Example of a Lake in Which Water Pollution Control Measures Were Successful (Der Rotsee - Ein Beispiel fur Einen See, Bei Dem Die Gewasserschutzmassnahmen Erfolge Brachten),
W83-02504 5G

Restoration of the Central Lakes: Baldeggersee, Hallwilersee, and Sempachersee. General Overview (Die Sanierung Dermittellandseen: Baldeggersee, Hallwilersee Und Sempachersee. Allgemeiner Uberblick),
W83-02558 5G

The Seasonal Variation of Organic Constituents in a Eutrophic Lake, Lake Suwa, Japan. Part 1, Particulate Organic Matter,
W83-02559 5C

EUTROPHICATION
Large-Scale Development of Cerataulina Bergonii Perag in the Northwestern Part of the Black Sea,
W83-02602 5C

Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

EVALUATION
Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

EVAPORATION
Ground-Water Recharge Rates in Minnesota as Related to Precipitation,
W83-02730 2F

EVAPORATION PANS
Surface Temperature Model for Evaporation Pans (Modelisation De La Temperature De Surface Des Bacs Evaporometriques),
W83-02673 2D

EVAPORATORS
Operation of Meff Desalination Plant (Multiple Effect Falling Film Process),
W83-02525 3A

Mathematical Model of a Mechanical Vapour Compression Evaporator. Application to Seawater Desalting. Part I-The Model Settlement,
W83-02526 3A

EVAPOTRANSPIRATION
The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

Weekly Water Use Estimates by Crops and Natural Vegetation in Indiana,
W83-02739 2D

EXCAVATION
Parameters of Canals Constructed by the Crater Blasting Method,
W83-02596 8H

EXPLORATION
Valles Caldera Geothermal Systems, New Mexico, U.S.A.,
W83-02701 2F

EXPLOSIVES
Parameters of Canals Constructed by the Crater Blasting Method,
W83-02596 8H

EXTRAPOLATION
Flow Computation Using Extrapolation Procedures,
W83-02695 2E

FAILURE ANALYSIS
Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

FARM MANAGEMENT
Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

FARMING
Effect of Subterranean Drainage on Some Properties of Clay Soils in Quebec (Effet du Drainage Souterrain Sur Quelques Proprietes de Sols Argileux du Quebec),
W83-02613 2G

FATE OF POLLUTANTS
Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

Trace Elements in Tissues of Commercial Fish From Lake Ladoga,
W83-02598 5B

Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

Fate of Acetone in Water,
W83-02645 5B

The Populations, Characterization and Activity of Suspended Bacteria in the Welsh River Dee,
W83-02707 5B

Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

FEDERAL REPUBLIC OF GERMANY
Wastewater Sludge Disinfection With Gamma-Rays: An Overview (Klarschlammhygienisierung Mit Gamma-Strahlen: Ein Uberblick),
W83-02505 5D

Electroflotation Purifies Chemical Wastewater (Elektroflotation Reinigt Chemieabwasser),
W83-02508 5D

Significance of River Flow for the Suspended Solids Burden and its Retention in the Impounded Ruhr (Bedeutung Des Abflusses Fur Die Schwebstofffracht Und Ihre Retention in Der Gestauten Ruhr),
W83-02587 2J

Anodic Oxidation for Drinking Water Disinfection, Part 1: Bacteriologic Studies in Practical Use (Anodische Oxydation Trinkwasserdesinfektion, 1. Mitteilug: Bakteriologische Untersuchungen Bei Praxiseinsatz),
W83-02588 5F

Anodic Oxidation for Drinking Water Disinfection, Part II: Studies on Haloform Formation (Anodische Oxidation Zur Trinkwasserdesinfektion, II. Mitteilung: Untersuchungen Zur Haloformbildung),
W83-02589 5F

The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

Biomass of Marine Macrofauna Communities in a Dumping Area of Sewage Sludge Near the Elbe Estuary (Die Biomasse Mariner Makrobenthos-Gesellschaften im Bemundung),
W83-02627 5C

Tidal Wave Analysis for Estuaries with Intertidal Flats,
W83-02637 2L

Pollution of Drinking Water With Nitrate,
W83-02646 5B

Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

Make Applications According to the State Wastewater Tax Laws on Time (Die Antrage Nach Den Landes-Abwasserabgabengesetzen Rechtzeitig Stellen),
W83-02786 6E

FEEDWATER TREATMENT
High Purity Water Using H202 and UV Radiation,
W83-02531 5F

FERTILIZERS
Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

FILTERS
The Degree of Utilization of Anion Exchange Filters in Nitrate Removal From Drinking Water (Ausnutzungsgrad Von Anionenaustauschfiltern Bei Der Nitratentfernung Aus Trinkwassern),
W83-02512 5F

Conventional, Upflow, and Radial Filters: Comparison and Mathematical Modelling,
W83-02615 5F

Numerical Convolution for Solution of Wave Propagation Problems: Filter Scheme Methods,
W83-02672 8B

A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

FILTRATE
Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

FILTRATION
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

The Expansion of the Uster Wastewater Treatment Facility--Fourth Treatment Stage--Wastewater Filtration Facility (Die Erweiterung Der Klaranlage Uster, 4. Reinigungsstuffe, Abwasswerfiltrationsanlage).
W83-02503 5D

Direct Filtration: Polymer in Backwash Serves Dual Purpose,
W83-02683 5D

Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

FINITE ELEMENT ANALYSIS
Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

Analysis of a Finite Element Algorithm for Numerical Predictions in Water Resources Research,
W83-02656 8B

FINITE ELEMENT METHOD
Tidal Wave Analysis for Estuaries with Intertidal Flats,
W83-02637 2L

FISH
The Influence of Kokanee Salmon and Man on the Water Quality of Lower McDonald Creek, Glacier National Park, Montana,
W83-02494 5C

PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

Trace Elements in Tissues of Commercial Fish From Lake Ladoga,
W83-02598 5B

FISH CONSERVATION
Cooling Systems: Can Engineers Save the Fish,
W83-02551 8I

FJORDS
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

Polychlorinated Biphenyls in the Sediments of the Inner Oslofjord,
W83-02783 5B

FLEXIBILITY
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

FLOATING PLANTS
Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

FLOCCULATION
The Expansion of the Uster Wastewater Treatment Facility--Fourth Treatment Stage--Wastewater Filtration Facility (Die Erweiterung Der Klaranlage Uster, 4. Reinigungsstuffe, Abwasswerfiltrationsanlage).
W83-02503 5D

Electroflotation Purifies Chemical Wastewater (Elektroflotation Reinigt Chemieabwasser),
W83-02508 5D

FLOOD CONTROL
Muskingum-Like Approximations for Water Routing,
W83-02696 2E

Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

Technology--What is it For. Two Examples from the More Than 2,000-Year History of Hydraulic Engineering in China (Technik Wozu. Zwei Beispiele Aus Der Uber 2000Jahrigen Geschichte Des Wasserbaues in China),
W83-02760 8A

FLOOD INSURANCE
The Economic Efficiency of Flood Plain Development,
W83-02477 6F

FLOOD PLAIN MANAGEMENT
The Economic Efficiency of Flood Plain Development,
W83-02477 6F

FLOOD PLAIN ZONING
The Economic Efficiency of Flood Plain Development,
W83-02477 6F

FLOOD PLAINS
Deposition of Sediments on Thicket-Covered Flood Plain,
W83-02605 2J

FLOODING
Effect of Soil and Coniferous Trees on Some Chemical Characteristics of the Water of Reservoir LG2 (Influence Des Sols Et Arbres Noyes Sur Quelques Caracteristiques Chimiques De L'Eau Du Reservoir LG2),
W83-02520 5B

FLOODS
Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

Sediment Deposition in a Flood-Retention Structure After Two Record Floods in Southwestern Wisconsin,
W83-02705 4D

FLOTATION
Electroflotation Purifies Chemical Wastewater (Elektroflotation Reinigt Chemieabwasser),
W83-02508 5D

FLOW
Thin Slender Water Jets,
W83-02677 8B

FLOW CONTROL
Waterflow Control,
W83-02534 8C

FLOW DISCHARGE
Saltation in Water Dynamics,
W83-02679 8B

FLOW MEASUREMENT
Flow Measurements at Raccoon Mountain,
W83-02535 8C

FLOW PATTERN
Multistage Whirlpool Shaft Spillways,
W83-02597 8A

FLOW PATTERNS
Computation of Flow Patterns in Rivers,
W83-02692 2E

FLOW RATES
Flow Measurements at Raccoon Mountain,
W83-02535 8C

FLUID MECHANICS
Analysis of a Finite Element Algorithm for Numerical Predictions in Water Resources Research,
W83-02656 8B

FLUSHING
Flushing and Shutoff Devices for Sewers (Spul- und Absperrorgane fur Abwasserkanale),
W83-02619 5D

FLUVIAL SEDIMENTS
Fluvial Hydraulics of Deltas and Alluvial Fans,
W83-02678 8B

FOOD CHAINS
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

FOOD WEBS
Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

FORECASTING
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

FOULING
Characterization of Fouling Potential for Pressure-Driven Membrane Processes: A New Simulated Flow Cell,
W83-02745 3A

FREEZING
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

FREQUENCY ANALYSIS
Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

FRESHWATER RECOVERY
Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

FUNGI
Nickel Toxicity to Fungi: Influence of Environmental Factors,
W83-02582 5C

GAMMA RADIATION
Wastewater Sludge Disinfection With Gamma-Rays: An Overview (Klarschlammhygienisierung Mit Gamma-Strahlen: Ein Uberblick),
W83-02505 5D

GAS CHROMATOGRAPHY
Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

GATES
Inspection and Maintenance of Dam Dewatering Facilities,
W83-02770 8C

GEOCHEMISTRY
Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

GEOHYDROLOGY
Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

Valles Caldera Geothermal Systems, New Mexico, U.S.A.,
W83-02701 2F

GEORGIA
Behavior of Uranium in Two Estuaries of the Southeastern United States,
W83-02465 2L

GEOTHERMAL POWER
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

GEOTHERMAL RESOURCES
Valles Caldera Geothermal Systems, New Mexico, U.S.A.,
W83-02701 2F

GEOTHERMAL STUDIES
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

GERMAN DEMOCRATIC REPUBLIC
Investigations on Seasonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

Improvement of the Accuracy of Prediction of Stochastic Models of the Oxygen Concentration in Running Waters (Verbessrung der Vorhersagegenauigkeit Stochastischer Modelle des Sauerstoffgehaltes von Fliessgewassern),
W83-02658 2E

GEYERS
The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

GLACIAL LAKES
Turbidity and its Causes in a Narrow Glacial Lake With Winter Ice Cover,
W83-02470 2H

GLACIER SURGES
Waves on Glaciers,
W83-02699 2C

GLACIERS
Waves on Glaciers,
W83-02699 2C

GOVERNMENT SUPPORTS
Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

GREAT BRITAIN
Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

GROUNDWATER
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

Symposium on Surface Coal Mining and Reclamation in the Northern Great Plains, an Update on Mine Spoils Hydrology Southeastern Montana,
W83-02495 2F

Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

Acidification of Groundwater in Norway,
W83-02793 2K

GROUNDWATER DATING
Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

GROUNDWATER DEPLETION
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

GROUNDWATER LEVEL FLUCTUATIONS
Ground-Water Recharge Rates in Minnesota as Related to Precipitation,
W83-02730 2F

GROUNDWATER MANAGEMENT
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

GROUNDWATER MINING
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

GROUNDWATER MOVEMENT
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

GROUNDWATER POLLUTION
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

The Role of Bentonite in Soil Sealing Applications,
W83-02662 5G

Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

GROUNDWATER RECHARGE
Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

Ground-Water Recharge Rates in Minnesota as Related to Precipitation,
W83-02730 2F

GULLIES
Gully Control: Determining Treatment Priorities for Gullies in a Network,
W83-02544 4D

HAITI
Case History of Sedimentation at Peligre Dam, Haiti (Cas Historique de Sedimentation du Barrage Peligre, Haiti),
W83-02611 2J

HALOFORMS
Anodic Oxidation for Drinking Water Disinfection, Part II: Studies on Haloform Formation (Anodische Oxidation Zur Trinkwasserdesinfektion, II. Mitteilung: Untersuchungen Zur Haloformbildung),
W83-02589 5F

HARBORS
Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

HAWAII
Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

HAZARDOUS MATERIALS
A Public Policy for Hazardous Wastes,
W83-02653 6E

HEAD LOSS
Conventional, Upflow, and Radial Filters: Comparison and Mathematical Modelling,
W83-02615 5F

HEAVY METAL
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

HEAVY METALS
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Ac-

tivated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

Fate of Heavy Metals and Potential For Clinker Formation During Pilot Scale Incineration of Municipal Sludge,
W83-02789 5E

HEMOGLOBIN
Hemoglobin-Glutathione Relationships in Trout Erythrocytes Treated With Monochloramine,
W83-02660 5C

HETEROTROPHIC BACTERIA
The Microbial Dynamics of an Epilithic Algal-Bacterial Mat Community in an Oligotrophic, High Alpine Stream,
W83-02490 5B

The Populations, Characterization and Activity of Suspended Bacteria in the Welsh River Dee,
W83-02707 5B

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY
Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

HISTORIC FLOODS
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

HISTORY
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

HONG KONG
The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

The Hundred-Year Effort to Secure Hong Kong's Water Supply (Hundertjahriges Bemuhen um Hong Kong's Wasserversorgung),
W83-02762 3B

HUMAN DISEASES
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

HUMAN POPULATION
Hydroelectric Power Utilization and Environmental Protection (Wasserkraftnutzung Und Umweltschutz),
W83-02788 6G

HYDRANTS
Maintaining Distribution System Valves and Fire Hydrants,
W83-02714 8C

Valve and Hydrant Maintenance,
W83-02782 5F

HYDRAULIC DESIGN
Design and Analysis of Urban Storm Drainage - The Wallingford Procedure,
W83-02550 2A

HYDRAULIC ENGINEERING
Technology--What is it For. Two Examples from the More Than 2,000-Year History of Hydraulic Engineering in China (Technik Wozu. Zwei Beispiele Aus Der Uber 2000Jahrigen Geschichte Des Wasserbaues in China),
W83-02760 8A

HYDRAULIC EQUIPMENT
Waterflow Control,
W83-02534 8C

Flow Measurements at Raccoon Mountain,
W83-02535 8C

HYDRAULIC LOSS
Improvement of the Power Output of Hydroelectric Plants (Verbesserung Der Leistungsfahigkeit Von Wasserkraftwerken),
W83-02800 8C

HYDRAULIC MACHINERY
Aspects of the Machine Foundation Design at Drakensberg,
W83-02667 8C

HYDRAULIC VALVES
Waterflow Control,
W83-02534 8C

HYDRAULICS
Fluvial Hydraulics of Deltas and Alluvial Fans,
W83-02678 8B

Well Hydraulics in Vertically Heterogeneous Formations,
W83-02693 2F

Flow Computation Using Extrapolation Procedures,
W83-02695 2E

HYDROBIOLOGY
Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

HYDROCARBONS
Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

HYDRODYNAMICS
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

Computation of Flow Patterns in Rivers,
W83-02692 2E

HYDROELECTRIC PLANTS
Unique Design for Guijo De Granadilla,
W83-02538 8C

Hydro-Fracturing at Helms,
W83-02539 8A

The Design of Drakensberg,
W83-02541 8A

Czechoslovakia's Largest Pumped-Storage Plant,
W83-02542 8A

Interaction of Large Hydraulic Engineering Systems with the Environment,
W83-02606 6G

Use of Energy Storage by Increasing the Head of the Hydroelectric Station-Pumped Storage Station,
W83-02620 8C

Technology--What is it For. Two Examples from the More Than 2,000-Year History of Hydraulic Engineering in China (Technik Wozu. Zwei Beispiele Aus Der Uber 2000Jahrigen Geschichte Des Wasserbaues in China),
W83-02760 8A

Improvement of the Power Output of Hydroelectric Plants (Verbesserung Der Leistungsfahigkeit Von Wasserkraftwerken),
W83-02800 8C

HYDROELECTRIC POWER
Building A Hydro Station in a Narrow Gorge,
W83-02543 8A

Hydroelectric Power Utilization and Environmental Protection (Wasserkraftnutzung Und Umweltschutz),
W83-02788 6G

HYDROELECTRIC POWERPLANTS
The Drakensberg Pumped Storage Scheme Description of Scheme and Principal Data,
W83-02671 8A

HYDROGEN ION CONCENTRATION
Ozonalysis for Water Reuse Applications,
W83-02498 5F

Acidification of Aquatic Systems: A Critique of Chemical Approaches,
W83-02567 2K

Effect of Denitrification on the pH in Biofilms,
W83-02752 5D

HYDROGEN PEROXIDE
Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

High Purity Water Using H202 and UV Radiation,
W83-02531 5F

Attacking Odors with H202,
W83-02765 5F

HYDROGEOLOGY
The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

HYDROGRAPHS
Muskingum-Like Approximations for Water Routing,
W83-02696 2E

HYDROLOGIC MODELS
Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

HYDROLOGIC SYSTEMS
Hydroelectric Power Utilization and Environmental Protection (Wasserkraftnutzung Und Umweltschutz),
W83-02788 6G

HYDROTHERMAL STUDIES
Theory of Hydrothermal Equilibria of Minerals of Variable Composition,
W83-02586 2K

ICE FORMATION
Experience in Predicting Elements of the Ice and Thermal Regime of the Lower Pools of Hydroelectric Stations,
W83-02621 2C

IDAHO
Identification of Snowcover Depletion Patterns Using Satellite Imagery,
W83-02488 2C

IDAHO

Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

ILLINOIS
A Model for Drainage Benefits,
W83-02452 4A

Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

IN-STREAM FLOW
Prediction of Effects of Daily Flow Fluctuations on Stream Biota,
W83-02480 6G

INCINERATION
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

Fate of Heavy Metals and Potential For Clinker Formation During Pilot Scale Incineration of Municipal Sludge,
W83-02789 5E

INDIA
Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

INDIANA
The Economic Efficiency of Flood Plain Development,
W83-02477 6F

Weekly Water Use Estimates by Crops and Natural Vegetation in Indiana,
W83-02739 2D

INDIRECT FREEZE CRYSTALLIZATION
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

INDUCED INFILTRATION
Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

INDUSTRIAL CHEMICALS
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

INDUSTRIAL WASTES
Industrial Effluent Control Experience,
W83-02530 5D

Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

INDUSTRIAL WASTEWATER
The Sea Effluent Pipeline - Environmental Blunder or Socio-Economic Boon.
W83-02517 5E

Treatment of Unusual Inorganic Wastes,
W83-02580 5D

Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

INFILTRATION
Use of Similarity Solutions for the Problem of A Wetting Front - A Question of Unique Representation,
W83-02638 2G

Field Determination of Infiltration Parameters (Bestimmung von Infiltrationsparametern mit Hilfe von Feldmessungen),
W83-02785 2G

INSPECTION
Inspection and Maintenance of Dam Dewatering Facilities,
W83-02770 8C

INSTALLATION
Designing and Installing Large Steel Water Mains to Prevent Failures,
W83-02710 5F

INTAKES
Cubelles Thermal Power Plant-A New Solution for the Intake and Discharge of Cooling Water (Centra Termica De Cubelles-Una Nueva Solucion Para la Toma Y Descarga de Agua de Refrigeracion),
W83-02795 8A

INTERNATIONAL COMMISSIONS
Monitoring Dams and Their Foundations,
W83-02629 8D

ION EXCHANGE
Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

Determination of Radium-228 in Foods and Water,
W83-02686 5A

Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

Continuous Countercurrent Ion Exchange for Desalination and Tertiary Treatment of Effluents and Other Brackish Waters,
W83-02792 3A

ION-EXCHANGE MEMBRANES
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

ION TRANSPORT
Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

IOWA
Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

IRON
Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

IRON OXIDATION
Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

IRRIGATION
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

The Economic Impacts of Alternatives and Contingencies Relating to the 1978 Decisions of the Montana Board of Natural Resources on Water Reservations in the Yellowstone Basin,
W83-02493 6B

Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

Technology--What is it For. Two Examples from the More Than 2,000-Year History of Hydraulic Engineering in China (Technik Wozu. Zwei Beispiele Aus Der Uber 2000Jahrigen Geschichte Des Wasserbaues in China),
W83-02760 8A

Release of Fe, Mn and P in a Calcareous Vertisol and Yield of Upland Rice as influenced by Presowing Soil Water Treatments,
W83-02797 2I

IRRIGATION DELIVERY EFFICIENCY
Analysis of Irrigation Pumping and Application Efficiency in Nevada,
W83-02499 3F

IRRIGATION ENGINEERING
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

IRRIGATION PRACTICES
Cotton Growth Related to Plant's Water Status,
W83-02576 3F

IRRIGATION STRATEGIES
Analysis of Irrigation Pumping and Application Efficiency in Nevada,
W83-02499 3F

ISOTOPE FRACTIONATION
Kinetic Fractionation of Carbon-13 During Calcium Carbonate Precipitation,
W83-02570 2K

ISOTOPE STUDIES
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

Oxygen-18 and Deuterium Determination on a Single Water Sample of a Few Milligrams,
W83-02651 1A

ISRAEL
Physico-Chemical Study of Dead Sea Water, II. Density Measurements and Equation of State of Dead Sea Water at 1 ATM,
W83-02464 2H

ITALY
Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

JAPAN
The Seasonal Variation of Organic Constituents in a Eutrophic Lake, Lake Suwa, Japan. Part 1, Particulate Organic Matter,
W83-02559 5C

JETS
Thin Slender Water Jets,
W83-02677 8B

KINETICS
Kinetic Fractionation of Carbon-13 During Calcium Carbonate Precipitation,
W83-02570 2K

Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

KLEBSIELLA
Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

KRAFT MILLS
The Effect of Chlorine Dioxide Substitution in the First Stage of Pulp Bleaching on Bleach Plant Effluent BOD,
W83-02469 5D

LABRADOR
Areal Differentiation of Land and Lake Snowcover in a Small Sub-Arctic Drainage Basin,
W83-02775 2C

LAKE MICHIGAN
Uptake, Depuration and Biotransformation of Anthracene by the Scud Pontoporeia Hoyi,
W83-02549 5B

LAKE RESTORATION
The Rotsee - An Example of a Lake in Which Water Pollution Control Measures Were Successful (Der Rotsee - Ein Beispiel fur Einen See, Bei Dem Die Gewasserschutzmassnahmen Erfolge Brachten),
W83-02504 5G

Restoration of the Central Lakes: Baldeggersee, Hallwilersee, and Sempachersee. General Overview (Die Sanierung Dermittellandseen: Baldeggersee, Hallwilersee Und Sempachersee. Allgemeiner Uberblick),
W83-02558 5G

Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

Further Action by the Cantons. Aargau Canton (Das Weitere Vorgehen Der Kantone. Kanton Aargau),
W83-02758 5G

Further Action by the Cantons. Lucerne Canton (Das Weitere Vorgehen Der Kantone. Kanton Luzern),
W83-02759 5G

LAKE SEDIMENTS
Further Action by the Cantons. Aargau Canton (Das Weitere Vorgehen Der Kantone. Kanton Aargau),
W83-02758 5G

LAKE WATER
Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

LAKES
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

Trace Elements in Tissues of Commercial Fish From Lake Ladoga,
W83-02598 5B

90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

LAND APPLICATION
Priority Pollutants in Municipal Sewage Sludge,
W83-02552 5E

Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

LAND DISPOSAL
Agricultural Use of Sugar Refinery Wastewater Change in Mineral Nitrogen in Soils Used for Landspreading (Valorisation Agricole Des Effluents En Sucrerie, Etude De L' Evolution De L' Azote Mineral Dans Les Sols Soumis Aux Epandages),
W83-02633 3C

LEACHING
Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

LEAD
The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

LEGISLATION
Responsibility for Runoff Control,
W83-02467 6E

LIGHT INTENSITY
Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

LIMITING CURRENT DESITY
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

LIMNOLOGY
The Effects of Limnological Processes on the Quality of Impounded Waters (Auswikungen Limnologischer Vorgange Auf Die Beschaffenheit Von Staugewassern),
W83-02784 2H

LINEAR PROGRAMMING
The Economic Impacts of Alternatives and Contingencies Relating to the 1978 Decisions of the Montana Board of Natural Resources on Water Reservations in the Yellowstone Basin,
W83-02493 6B

LINEAR STABILITY ANALYIS
Thermohaline Convection in a Nonhomogeneous Aquifer,
W83-02675 2F

LININGS
Concrete Waterway Linings for the Drakensberg Pumped Storage Scheme,
W83-02668 8F

LITERATURE REVIEW
The Isolation of Bacteriophages from the Environment,
W83-02708 5A

LITERATURE REVIEWS
Distribution of Actinomycetes in Natural Waters (A Survey),
W83-02624 5B

Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

LITTER
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

LOS ANGELES
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

LOW-HEAD TURBINES
Experience Curves for Feasibility Studies and Planning of Modern Low-Head Hydro Turbines,
W83-02489 8C

MACROINVERTEBRATES
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

MAINE
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

MAINTENANCE
Flushing and Shutoff Devices for Sewers (Spul- und Absperrorgane fur Abwasserkanale),
W83-02619 5D

Rock Balls at Folsom Dam, California,
W83-02661 8F

Maintaining Aging Systems - Boston's Approach,
W83-02689 5F

Organizing and Analyzing Leak and Break Data for Making Main Replacement Decisions,
W83-02712 5F

Inspecting, Painting, and Maintaining Steel Water Tanks,
W83-02713 8G

Valve and Hydrant Maintenance,
W83-02782 5F

MAINTENANCE COSTS
Seeking Consumers Cooperation in the Financing of Water Supply (Conditions Permettant Aux Consommateurs A Ressources Limitees De Participer Au Financement De Leur Consommation D Eau),
W83-02634 6C

MANAGEMENT
The Crest Dispute: A Mediation Success,
W83-02532 6D

MANURE
Pollution of Drinking Water With Nitrate,
W83-02646 5B

MAPS
Quantifying Source Areas Through Land Surface Curvature and Shape,
W83-02702 2E

MARINE ANIMALS
Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

MARINE SEDIMENTS
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

MARYLAND
Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

MASS TRANSFER
Mass-Transfer Characteristics Within Microbial Systems,
W83-02749 5D

MASSACHUSETTS
Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

MATHEMATICAL EQUATIONS
Drainage Coefficients,
W83-02454 4A

Use of Similarity Solutions for the Problem of A Wetting Front - A Question of Unique Representation,
W83-02638 2G

Thin Slender Water Jets,
W83-02677 8B

Celerity of Transient Bed Profiles,
W83-02694 2J

Flow Computation Using Extrapolation Procedures,
W83-02695 2E

Lateral Bed Load Transport on Side Slopes,
W83-02709 8B

Field Determination of Infiltration Parameters (Bestimmung von Infiltrationsparametern mit Hilfe von Feldmessungen),
W83-02785 2G

MATHEMATICAL MODELS
Mathematical Model of a Mechanical Vapour Compression Evaporator. Application to Seawater Desalting. Part I-The Model Settlement,
W83-02526 3A

Safety Monitoring of Concrete Dams,
W83-02632 8F

Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

Surface Temperature Model for Evaporation Pans (Modelisation De La Temperature De Surface Des Bacs Evaporometriques),
W83-02673 2D

Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

MATHEMATICAL STUDIES
Use of the Extremal-3 Distribution in Precipitation Evaluation and Low Water Analysis (Die Anwendung Der Extremal-3-Verteilung Bei Der Regenauswertung Und Der Niedrigwasseranalyse),
W83-02590 2B

Surges of Finite Height,
W83-02631 8B

Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

The Hydrophobic Interaction Is Long Range, Decaying Exponentially with Distance,
W83-02778 1B

MAYFLIES
Prediction of Effects of Daily Flow Fluctuations on Stream Biota,
W83-02480 6G

MEASURING INSTRUMENTS
Automatic Tensiometer Scanner for Rapid Measurements,
W83-02458 7B

Norwegian Practice in Instrumenting Dams,
W83-02630 8G

Measurement and Modeling of Microwave Emission from Forested Snowfields in Michigan,
W83-02774 2C

Detection of Rainfall Rates Utilizing Spaceborne Microwave Radiometers,
W83-02798 2B

MEMBRANE PROCESSES
Characterization of Fouling Potential for Pressure-Driven Membrane Processes: A New Simulated Flow Cell,
W83-02745 3A

MEMBRANES
Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

Characterization of Fouling Potential for Pressure-Driven Membrane Processes: A New Simulated Flow Cell,
W83-02745 3A

MERCURY
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

MEROMICTIC LAKES. *CHEMOCLINE
Lake Fidler, a Meromictic Lake in Tasmania,
W83-02557 2H

METAL COMPLEXES
Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

METALS
The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

Treatment of Unusual Inorganic Wastes,
W83-02580 5D

Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

METHANE
Salting-Out of Methane in Single-Salt Solutions at 25 Degrees C and Below 800 PSIA,
W83-02583 2K

METHYLATION
Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

METROPOLITAN WATER MANAGEMENT
Seeking Consumers Cooperation in the Financing of Water Supply (Conditions Permettant Aux Consommateurs A Ressources Limitees De Participer Au Financement De Leur Consommation D Eau),
W83-02634 6C

MICHIGAN
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

Prediction of Effects of Daily Flow Fluctuations on Stream Biota,
W83-02480 6G

Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

Measurement and Modeling of Microwave Emission from Forested Snowfields in Michigan,
W83-02774 2C

MICROBIAL DEGRADATION
Acclimation to and Biodegradation of Nitrilotriacetate (NTA) at Trace Concentrations in Natural Waters,
W83-02461 5B

Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

Mass-Transfer Characteristics Within Microbial Systems,
W83-02749 5D

MICROBIOLOGICAL STUDIES
The Microbial Dynamics of an Epilithic Algal-Bacterial Mat Community in an Oligotrophic, High Alpine Stream,
W83-02490 5B

MICROENVIRONMENT
Biomass of Marine Macrofauna Communities in a Dumping Area of Sewage Sludge Near the Elbe Estuary (Die Biomasse Mariner Makrobenthos-Gesellschaften im Bemundung),
W83-02627 5C

MICRORESINS
Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

MINE WASTEWATERS
Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

MINERAL CENTER
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

MINERALIZATION
Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

MINERALS
Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

Theory of Hydrothermal Equilibria of Minerals of Variable Composition,
W83-02586 2K

MINNESOTA
Start-Up and Operation of an Oxygen-Activated Advance Wastewater Treatment System,
W83-02680 5D

Ground-Water Recharge Rates in Minnesota as Related to Precipitation,
W83-02730 2F

MISSISSIPPI
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

MIXING
Behavior of Uranium in Two Estuaries of the Southeastern United States,
W83-02465 2L

Turbidity and its Causes in a Narrow Glacial Lake With Winter Ice Cover,
W83-02470 2H

MODEL STUDIES
A Model for Drainage Benefits,
W83-02452 4A

Modeling Sediment Deposition Behind Corn Residue,
W83-02455 4D

The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

Acid-Base Equilibrium During Photosynthesis in Water,
W83-02600 2K

Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

Improvement of the Accuracy of Prediction of Stochastic Models of the Oxygen Concentration in Running Waters (Verbessrung der Vorhersagegenauigkeit Stochastischer Modelle des Sauerstoffgehaltes von Fliessgewassern),
W83-02658 2E

Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

Muskingum-Like Approximations for Water Routing,
W83-02696 2E

Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

Characterization of Fouling Potential for Pressure-Driven Membrane Processes: A New Simulated Flow Cell,
W83-02745 3A

Biological Nitrification in an Up Flow Fixed Bed Reactor (UFBR),
W83-02747 5D

A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

Measurement and Modeling of Microwave Emission from Forested Snowfields in Michigan,
W83-02774 2C

Application of the Marais - Ekama Activated Sludge Model to Large Plants,
W83-02791 5E

Computer Assisted Analysis to Improve Water System Operation,
W83-02799 5F

MODEL TESTING
Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

MOISTURE STRESS
Cotton Growth Related to Plant's Water Status,
W83-02576 3F

MOLLUSKS
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

MONITORING
Instrumenting Australia's Cethana Dam,
W83-02603 8A

Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

Safety Monitoring of Concrete Dams,
W83-02632 8F

Toxic Substances Monitoring Program - 1981,
W83-02719 5A

Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

MONOCHLORAMINE
Hemoglobin-Glutathione Relationships in Trout Erythrocytes Treated With Monochloramine,
W83-02660 5C

MONSOONS
Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

MONTANA
The Microbial Dynamics of an Epilithic Algal-Bacterial Mat Community in an Oligotrophic, High Alpine Stream,
W83-02490 5B

The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

Parameters of Deteriorating Microbiological Quality of Selected Surface Waters in Residential Missoula, Montana,
W83-02492 5B

The Economic Impacts of Alternatives and Contingencies Relating to the 1978 Decisions of the Montana Board of Natural Resources on Water Reservations in the Yellowstone Basin,
W83-02493 6B

The Influence of Kokanee Salmon and Man on the Water Quality of Lower McDonald Creek, Glacier National Park, Montana,
W83-02494 5C

Symposium on Surface Coal Mining and Reclamation in the Northern Great Plains, an Update on Mine Spoils Hydrology Southeastern Montana,
W83-02495 2F

Pesticides in Lower Flathead Valley Drainage,
W83-02496 5A

Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

MORPHOLOGY
Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

MUNICIPAL WASTEWATER
Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

MUNICIPAL WATER
Maintaining Aging Systems - Boston's Approach,
W83-02689 5F

MUNICIPAL WATER CONSERVATION
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

MUSKINGUM METHODS
Muskingum-Like Approximations for Water Routing,
W83-02696 2E

MUTAGENS
Formation and Removal of Mutagenic Activity in Drinking Water by Ozonisation,
W83-02510 5F

Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

MYRIOPHYLLUM
Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

NATURAL WATERS
Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

NEVADA
Analysis of Irrigation Pumping and Application Efficiency in Nevada,
W83-02499 3F

NEW MEXICO
Valles Caldera Geothermal Systems, New Mexico, U.S.A.,
W83-02701 2F

NEW YORK
Turbidity and its Causes in a Narrow Glacial Lake With Winter Ice Cover,
W83-02470 2H

Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

NEW YORK BIGHT
Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

NICKEL
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

Nickel Toxicity to Fungi: Influence of Environmental Factors,
W83-02582 5C

NILE RIVER DELTA
Land-Use and Management Problems in the Nile Delta,
W83-02462 6G

NITRATE
Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

NITRATES
The Degree of Utilization of Anion Exchange Filters in Nitrate Removal From Drinking Water (Ausnutzungsgrad Von Anionenaustauschfiltern Bei Der Nitratentfernung Aus Trinkwassern),
W83-02512 5F

Pollution of Drinking Water With Nitrate,
W83-02646 5B

NITRIFICATION
Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

NITRIFIVATION
Biological Nitrification in an Up Flow Fixed Bed Reactor (UFBR),
W83-02747 5D

NITRILOTRIACETIC ACID
The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

NITRILOTRIACETIC ACID, *DEGRADATION
Acclimation to and Biodegradation of Nitrilotriacetate (NTA) at Trace Concentrations in Natural Waters,
W83-02461 5B

NITRITES
Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

NITROGEN
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

Agricultural Use of Sugar Refinery Wastewater Change in Mineral Nitrogen in Soils Used for Landspreading (Valorisation Agricole Des Effluents En Sucrerie, Etude De L' Evolution De L' Azote Mineral Dans Les Sols Soumis Aux Epandages),
W83-02633 3C

Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

NITROGEN COMPOUNDS
Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

NITROGEN REMOVAL
The Degree of Utilization of Anion Exchange Filters in Nitrate Removal From Drinking Water (Ausnutzungsgrad Von Anionenaustauschfiltern Bei Der Nitratentfernung Aus Trinkwassern),
W83-02512 5F

Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

NONPOINT POLLUTION SOURCES
Pollution of Drinking Water With Nitrate,
W83-02646 5B

NONYL PHENOLS
Persistent Organic Chemicals in Sewage Effluents. 2. Quantitative Determinations of Nonylphenols and Nonylphenol Ethoxylates by Glass Capillary Gas Chromatography,
W83-02529 5A

NORTH CAMEROON
Slow Sand Filtration for Cercarial Control in North Cameroon Village Water Supply,
W83-02790 5F

NORWAY
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

Polychlorinated Biphenyls in the Sediments of the Inner Oslofjord,
W83-02783 5B

Acidification of Groundwater in Norway,
W83-02793 2K

NOZZLES
Thin Slender Water Jets,
W83-02677 8B

NUMERICAL CONVOLUTION
Numerical Convolution for Solution of Wave Propagation Problems: Filter Scheme Methods,
W83-02672 8B

NUTRIENT REMOVAL
Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

NUTRIENTS
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

Release of Fe, Mn and P in a Calcareous Vertisol and Yield of Upland Rice as influenced by Presowing Soil Water Treatments,
W83-02797 2I

OCEAN DUMPING
Sludge Disposal in Southern California Basins,
W83-02527 5E

Initial Sedimentation of Waste Particulates Discharged From Ocean Outfalls,
W83-02565 5B

ODOR
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

OLIGOTROPHIC LAKES
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

ONTARIO
The Effect on Storm Runoff Response of Seasonal Variations in Contributing Zones in Small Watersheds,
W83-02779 2A

OPERATING COSTS
Seeking Consumers Cooperation in the Financing of Water Supply (Conditions Permettant Aux Consommateurs A Ressources Limitees De Participer Au Financement De Leur Consommation D Eau),
W83-02634 6C

OPTIMIZATION
Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

OREGON
Halting Creek Pollution,
W83-02768 5B

ORGANIC CARBON
Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

Comparative Seasonal Uptake of Glucose and Acetate by Epiphytic Bacteria on the Surfaces of Three Species of Macrophyte in the Littoral Zone of Lake Ohrid, Yugoslavia,
W83-02556 2H

Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

ORGANIC COMPOUNDS
Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

The Occurrence of PCH3-Containing Compounds in Surface Waters,
W83-02518 5A

The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

Uptake, Depuration and Biotransformation of Anthracene by the Scud Pontoporeia Hoyi,
W83-02549 5B

Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

ORGANIC MATTER
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

The Seasonal Variation of Organic Constituents in a Eutrophic Lake, Lake Suwa, Japan. Part 1, Particulate Organic Matter,
W83-02559 5C

Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

ORGANIC POLLUTANTS
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

ORGANIC SOLVENTS
Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

ORGANIC WASTES
Superbugs: Bacteria for Wastewater Treatment Plants,
W83-02769 5D

ORGANOCHLORINES
Evaluation of Organochlorine Contents in the Saint Lawrence River, Estuary and Gulf, Canada (Evaluation Des Teneurs En Composes Organochlores Dans Le Fleuve, L'Estuaire Et Le Golfe Saint-Laurent, Canada),
W83-02578 5B

ORGANOLEPTIC PROPERTIES
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

OUTDOOR RECREATION
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

OUTFALL
The Sea Effluent Pipeline - Environmental Blunder or Socio-Economic Boon.
W83-02517 5E

OUTFALL SEWERS
The Sea Effluent Pipeline - Environmental Blunder or Socio-Economic Boon.
W83-02517 5E

OUTLETS
The Sterkfontein Dam Outlet Works,
W83-02666 8A

Inspection and Maintenance of Dam Dewatering Facilities,
W83-02770 8C

OVERFLOW
Overflow Road Crossing Across the Dnestr River at the Construction Site of the Dnestr Hydrostation,
W83-02594 8A

OXIDATION
Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

Practical Determination of the First Stage BOD of Sewage,
W83-02581 5A

Anodic Oxidation for Drinking Water Disinfection, Part II: Studies on Haloform Formation (Anodische Oxidation Zur Trinkwasserdesinfektion, II. Mitteilung: Untersuchungen Zur Haloformbildung),
W83-02589 5F

Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

Attacking Odors with H202,
W83-02765 5F

OXYGEN BALANCE
Improvement of the Accuracy of Prediction of Stochastic Models of the Oxygen Concentration in Running Waters (Verbessrung der Vorhersagegenauigkeit Stochastischer Modelle des Sauerstoffgehaltes von Fliessgewassern),
W83-02658 2E

OXYGEN ISOTOPES
Oxygen-18 and Deuterium Determination on a Single Water Sample of a Few Milligrams,
W83-02651 1A

OXYGEN TRANSFER
The Scale-Up and Limitation of Physical Oxygen Transfer in Rotating Biological Contactors,
W83-02750 5D

OXYGENATION
Start-Up and Operation of an Oxygen-Activated Advance Wastewater Treatment System,
W83-02680 5D

OZONATION
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

A Small Facility for the Ozone Treatment of Water (Kleinanlage Zur Ozonbehandlung Von Wasser),
W83-02509 5F

Formation and Removal of Mutagenic Activity in Drinking Water by Ozonisation,
W83-02510 5F

Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

OZONE
Ozonalysis for Water Reuse Applications,
W83-02498 5F

Decomposition of Ozone in Water: Rate of Initiation by Hydroxide Ions and Hydrogen Peroxide,
W83-02577 5F

PAN EVAPORATION
Surface Temperature Model for Evaporation Pans (Modelisation De La Temperature De Surface Des Bacs Evaporometriques),
W83-02673 2D

PAPER CHROMATOGRAPHY
Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

PARKS
Halting Creek Pollution,
W83-02768 5B

PARTICLE SIZE
Estimation of the Size and Roughness of Sediments in Hydraulic Calculations,
W83-02622 8B

PARTICULATE MATTER
The Seasonal Variation of Organic Constituents in a Eutrophic Lake, Lake Suwa, Japan. Part 1, Particulate Organic Matter,
W83-02559 5C

PATH OF POLLUTANTS
Behavior of Uranium in Two Estuaries of the Southeastern United States,
W83-02465 2L

Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

PATHOGENIC BACTERIA
Parameters of Deteriorating Microbiological Quality of Selected Surface Waters in Residential Missoula, Montana,
W83-02492 5B

PCH3 COMPOUNDS
The Occurrence of PCH3-Containing Compounds in Surface Waters,
W83-02518 5A

PENNSYLVANIA
Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

PERFORMANCE EVALUATION
Flow Measurements at Raccoon Mountain,
W83-02535 8C

Conventional, Upflow, and Radial Filters: Comparison and Mathematical Modelling,
W83-02615 5F

PERIPHYTON
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

PERMSELECTIVE MEMBRANES
Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

PERSONNEL
Effective Start-Up Training for Wastewater Treatment Plants,
W83-02772 5D

PESTICIDE RESIDUE
Pesticides in Lower Flathead Valley Drainage,
W83-02496 5A

PESTICIDE RESIDUES
Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

PHENOLS
Persistent Organic Chemicals in Sewage Effluents. 2. Quantitative Determinations of Nonylphenols and Nonylphenol Ethoxylates by Glass Capillary Gas Chromatography,
W83-02529 5A

PHILIPPINES
Spillway Aeration of the San Roque Project,
W83-02540 8B

PHOSPHORUS
The Rotsee - An Example of a Lake in Which Water Pollution Control Measures Were Suc-

cessful (Der Rotsee - Ein Beispiel fur Einen See, Bei Dem Die Gewasserschutzmassnahmen Erfolge Brachten),
W83-02504 5G

Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

PHOSPHORUS REMOVAL
The Expansion of the Uster Wastewater Treatment Facility--Fourth Treatment Stage--Wastewater Filtration Facility (Die Erweiterung Der Klaranlage Uster, 4. Reinigungsstuffe, Abwasswerfiltrationsanlage).
W83-02503 5D

Restoration of the Central Lakes: Baldeggersee, Hallwilersee, and Sempachersee. General Overview (Die Sanierung Dermittellandseen: Baldeggersee, Hallwilersee Und Sempachersee. Allgemeiner Uberblick),
W83-02558 5G

Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

Further Action by the Cantons. Aargau Canton (Das Weitere Vorgehen Der Kantone. Kanton Aargau),
W83-02758 5G

PHOTOCHEMICAL DEGRADATION
The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

PHOTODEGRADATION
Fate of Acetone in Water,
W83-02645 5B

PHOTOSYNTHESIS
Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

Acid-Base Equilibrium During Photosynthesis in Water,
W83-02600 2K

PHOTOTROPISM
The Microbial Dynamics of an Epilithic Algal-Bacterial Mat Community in an Oligotrophic, High Alpine Stream,
W83-02490 5B

PHYSICAL PROPERTIES
The Hydrophobic Interaction Is Long Range, Decaying Exponentially with Distance,
W83-02778 1B

PIEZOMETERS
Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

PILOT PLANTS
Direct Filtration: Polymer in Backwash Serves Dual Purpose,
W83-02683 5D

Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

Further Action by the Cantons. Lucerne Canton (Das Weitere Vorgehen Der Kantone. Kanton Luzern),
W83-02759 5G

PINEAPPLE
Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

PIPELINES
The Sea Effluent Pipeline - Environmental Blunder or Socio-Economic Boon.
W83-02517 5E

Designing and Installing Large Steel Water Mains to Prevent Failures,
W83-02710 5F

PLANNING
The Crest Dispute: A Mediation Success,
W83-02532 6D

Gully Control: Determining Treatment Priorities for Gullies in a Network,
W83-02544 4D

Restoration of the Central Lakes: Baldeggersee, Hallwilersee, and Sempachersee. General Overview (Die Sanierung Dermittellandseen: Baldeggersee, Hallwilersee Und Sempachersee. Allgemeiner Uberblick),
W83-02558 5G

Water Resources Research Coordination and Planning in the Colorado River-Great Basin Region,
W83-02744 9D

Improvement of the Power Output of Hydroelectric Plants (Verbesserung Der Leistungsfahigkeit Von Wasserkraftwerken),
W83-02800 8C

PLANNING TECHNIQUES
Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

PLANT GROWTH
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

Cotton Growth Related to Plant's Water Status,
W83-02576 3F

The Adaptation of Varieties of Sorghum to Different Water Regimes,
W83-02612 2I

Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

POLAR REGIONS
Areal Differentiation of Land and Lake Snowcover in a Small Sub-Arctic Drainage Basin,
W83-02775 2C

POLLUTANT IDENTIFICATION
Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

Pesticides in Lower Flathead Valley Drainage,
W83-02496 5A

Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

Persistent Organic Chemicals in Sewage Effluents. 2. Quantitative Determinations of Nonylphenols and Nonylphenol Ethoxylates by Glass Capillary Gas Chromatography,
W83-02529 5A

Acidification of Aquatic Systems: A Critique of Chemical Approaches,
W83-02567 2K

Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

The Potentiometric Titration of Sulfide in Wastewater Using A Sensitive Electrode (Die Potentiometrische Titration Von Sulfid in Abwasser Mit Hilfe Einer Sensitiven Elektrode),
W83-02639 5A

Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

Measuring Chlorine Dioxide With a Rotating Voltammetric Membrane Electrode.
W83-02682 5A

Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

Determination of Radium-228 in Foods and Water,
W83-02686 5A

Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

The Isolation of Bacteriophages from the Environment,
W83-02708 5A

Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

Toxic Substances Monitoring Program - 1981,
W83-02719 5A

Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

POLLUTION LOAD

Effluent Limitations Based on Water Quality,
W83-02466 5E

Investigations on Seasonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

POLLUTION TAXES

Make Applications According to the State Wastewater Tax Laws on Time (Die Antrage Nach Den Landes-Abwasserabgabengesetzen Rechtzeitig Stellen),
W83-02786 6E

POLY (BROMOPHENYLENE OXIDE DIMETHYL PHOSPHONATE ESTER)

Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

POLY (PHENYLENE OXIDE DIMETHYL PHOSPHONATE ESTER)

Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

POLYCHLORINATED BIPHENYL

PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

POLYCHLORINATED BIPHENYLS

Polychlorinated Biphenyls in the Sediments of the Inner Oslofjord,
W83-02783 5B

POLYELECTROLYTES

Direct Filtration: Polymer in Backwash Serves Dual Purpose,
W83-02683 5D

Survey of Polyelectrolyte Coagulant Use in the United States,
W83-02691 5F

POLYMERS

The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

Direct Filtration: Polymer in Backwash Serves Dual Purpose,
W83-02683 5D

POLYNUCLEAR AROMATIC HYDROCARBONS

Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

POPULATION DYNAMICS

Effects of Impoundment of Desaulniers Reservoir (James Bay Territory) on Zooplankton in a River and a String Bog. (Effets De La Mise En Eau Du Reservoir Desaulniers (Territoire De La Baie De James) Sur Le Zooplancton D'Une Riviere Et D'Une Tourbiere Reticulee),
W83-02604 6G

The Populations, Characterization and Activity of Suspended Bacteria in the Welsh River Dee,
W83-02707 5B

PORE PRESSURE

Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

POROUS MEDIA

Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

POTABLE WATER

Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

POTASIUM PERMANGANATE

Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

POTASSIUM

Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

POTASSIUM COMPOUNDS

Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

POTASSIUM DICHROMATE

Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

POTENTIOMETERS

The Potentiometric Titration of Sulfide in Wastewater Using A Sensitive Electrode (Die Potentiometrische Titration Von Sulfid in Abwasser Mit Hilfe Einer Sensitiven Elektrode),
W83-02639 5A

POWERPLANTS

Project Studies and Research Work Concerning Butterfly Valves as Used in Water Power Stations and Retarding Basins (Planungakriterien Und Forschung Bei Drosselklappen Fur Kraftwerksanlagen Und Ruckhaltebecken),
W83-02761 8C

Cubelles Thermal Power Plant-A New Solution for the Intake and Discharge of Cooling Water (Centra Termica De Cubelles-Una Nueva Solucion Para la Toma Y Descarga de Agua de Refrigeracion),
W83-02795 8A

PRECIPITATION

Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

Use of the Extremal-3 Distribution in Precipitation Evaluation and Low Water Analysis (Die Anwendung Der Extremal-3-Verteilung Bei Der Regenauswertung Und Der Niedrigwasseranalyse),
W83-02590 2B

Economics of Precipitant Use in Municipal Wastewater Treatment Plants (Wirtschaftlichkeit Des Fallmitteleinsatzes in Kommunalen Klaranlagen),
W83-02591 5D

PRECISION

Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

PREDICTION

Analysis of a Finite Element Algorithm for Numerical Predictions in Water Resources Research,
W83-02656 8B

PREOZONATION

The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

PRESSURE-MEASURING INSTRUMENTS

Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

PRICES

Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

PRICING

Much More to Rates Than Tradition,
W83-02781 6C

PRIMARY PRODUCTIVITY

Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

PROBABILISTIC PROCESS

Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

PROCESS CONTROL

Effective Start-Up Training for Wastewater Treatment Plants,
W83-02772 5D

PRODUCTIVITY

Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

PROJECT PLANNING

Water Resources Research Coordination and Planning in the Colorado River-Great Basin Region,
W83-02744 9D

Further Action by the Cantons. Aargau Canton (Das Weitere Vorgehen Der Kantone. Kanton Aargau),
W83-02758 5G

Further Action by the Cantons. Lucerne Canton (Das Weitere Vorgehen Der Kantone. Kanton Luzern),
W83-02759 5G

PROPERTY VALUE
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

PUBLIC HEALTH
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

Slow Sand Filtration for Cercarial Control in North Cameroon Village Water Supply,
W83-02790 5F

PUBLIC POLICY
A Public Policy for Hazardous Wastes,
W83-02653 6E

PULP WASTES
The Effect of Chlorine Dioxide Substitution in the First Stage of Pulp Bleaching on Bleach Plant Effluent BOD,
W83-02469 5D

PUMP TURBINES
Flow Measurements at Raccoon Mountain,
W83-02535 8C

Use of Energy Storage by Increasing the Head of the Hydroelectric Station-Pumped Storage Station,
W83-02620 8C

PUMPED STORAGE
Flow Measurements at Raccoon Mountain,
W83-02535 8C

Developments in Pump-Turbines,
W83-02536 8C

Unique Design for Guijo De Granadilla,
W83-02538 8C

Hydro-Fracturing at Helms,
W83-02539 8A

The Design of Drakensberg,
W83-02541 8A

Czechoslovakia's Largest Pumped-Storage Plant,
W83-02542 8A

Surge Chamber Design for Jukla,
W83-02572 8E

Use of Energy Storage by Increasing the Head of the Hydroelectric Station-Pumped Storage Station,
W83-02620 8C

The Construction of the Tugela-Vaal Project Dams,
W83-02643 8A

The Dams of the Tugela-Vaal Project,
W83-02648 8A

Environmental Considerations of the Drakensberg Pumped Storage Scheme,
W83-02664 6G

Aspects of the Machine Foundation Design at Drakensberg,
W83-02667 8C

The Drakensberg Pumped Storage Scheme Description of Scheme and Principal Data,
W83-02671 8A

PURIFICATION
A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

QUEBEC
Effect of Soil and Coniferous Trees on Some Chemical Characteristics of the Water of Reservoir LG2 (Influence Des Sols Et Arbres Noyes Sur Quelques Caracteristiques Chimiques De L'Eau Du Reservoir LG2),
W83-02520 5B

Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

Effect of Subterranean Drainage on Some Properties of Clay Soils in Quebec (Effet du Drainage Souterrain Sur Quelques Proprietes de Sols Argileux du Quebec),
W83-02613 2G

RADIOMETRY
Detection of Rainfall Rates Utilizing Spaceborne Microwave Radiometers,
W83-02798 2B

RADIUM RADIOISOTOPES
Determination of Radium-228 in Foods and Water,
W83-02686 5A

RAINFALL
Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

RAINFALL INTENSITY
Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

RAINFALL RATE
Detection of Rainfall Rates Utilizing Spaceborne Microwave Radiometers,
W83-02798 2B

RAINFALL-RUNOFF RELATIONSHIPS
Design and Analysis of Urban Storm Drainage - The Wallingford Procedure,
W83-02550 2A

Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

RAPID FILTERS
Conventional, Upflow, and Radial Filters: Comparison and Mathematical Modelling,
W83-02615 5F

RECHARGE
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

RECLAIMED WATER
Detection of Potential Carcinogens and Toxicants in Tap and Reclaimed Water by the Golden Hamster Cell Transformation Assay,
W83-02460 5A

RECREATION DEMAND
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

RECREATION FACILITIES
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

REGIONAL PLANNING
Water Resources Research Coordination and Planning in the Colorado River-Great Basin Region,
W83-02744 9D

REGRESSION ANALYSIS
Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

REMOTE SENSING
Remote Sensing Determination of Hydrograph Recession Characteristics,
W83-02487 2A

Identification of Snowcover Depletion Patterns Using Satellite Imagery,
W83-02488 2C

RESEARCH PRIORITIES
Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

RESERVOIR OPERATION
The Design of Drakensberg,
W83-02541 8A

RESERVOIR STAGES
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

RESERVOIR STORAGE
Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

RESERVOIRS
Effect of Soil and Coniferous Trees on Some Chemical Characteristics of the Water of Reservoir LG2 (Influence Des Sols Et Arbres Noyes Sur Quelques Caracteristiques Chimiques De L'Eau Du Reservoir LG2),
W83-02520 5B

Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

Significance of River Flow for the Suspended Solids Burden and its Retention in the Impounded Ruhr (Bedeutung Des Abflusses Fur Die Schwebstofffracht Und Ihre Retention in Der Gestauten Ruhr),
W83-02587 2J

Effects of Impoundment of Desaulniers Reservoir (James Bay Territory) on Zooplankton in a River and a String Bog. (Effets De La Mise En Eau Du Reservoir Desaulniers (Territoire De La Baie De James) Sur Le Zooplancton D'Une Riviere Et D'Une Tourbiere Reticulee),
W83-02604 6G

Case History of Sedimentation at Peligre Dam, Haiti (Cas Historique de Sedimentation du Barrage Peligre, Haiti),
W83-02611 2J

Experience in Predicting Elements of the Ice and Thermal Regime of the Lower Pools of Hydroelectric Stations,
W83-02621 2C

Urgent Problems of Conservation and Rational Use of Water Resources,
W83-02623 5G

Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

The Hundred-Year Effort to Secure Hong Kong's Water Supply (Hundertjahriges Bemuhen um Hong Kong's Wasserversorgung),
W83-02762 3B

Keeping Clean Water Clean,
W83-02780 5F

The Effects of Limnological Processes on the Quality of Impounded Waters (Auswikungen Limnologischer Vorgange Auf Die Beschaffenheit Von Staugewassern),
W83-02784 2H

RESINS
The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

RETURN FLOW
The Economic Impacts of Alternatives and Contingencies Relating to the 1978 Decisions of the Montana Board of Natural Resources on Water Reservations in the Yellowstone Basin,
W83-02493 6B

REVERSE OSMOSIS
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

REVIEWS
Evaluation of Organochlorine Contents in the Saint Lawrence River, Estuary and Gulf, Canada (Evaluation Des Teneurs En Composes Organochlores Dans Le Fleuve, L'Estuaire Et Le Golfe Saint-Laurent, Canada),
W83-02578 5B

RHEOLOGY
The Use of Rheology for Sludge Characterization,
W83-02757 5D

RICE
Release of Fe, Mn and P in a Calcareous Vertisol and Yield of Upland Rice as influenced by Presowing Soil Water Treatments,
W83-02797 2I

RIPARIAN RIGHTS
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

RISKS
Priority Pollutants in Municipal Sewage Sludge,
W83-02552 5E

RIVER BASIN DEVELOPMENT
Water Resources Research Coordination and Planning in the Colorado River-Great Basin Region,
W83-02744 9D

RIVER BASINS
Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

RIVER BEDS
Bed Characteristics in Alluvial Channel Bends,
W83-02698 2J

RIVER FLOW
Significance of River Flow for the Suspended Solids Burden and its Retention in the Impounded Ruhr (Bedeutung Des Abflusses Fur Die Schwebstofffracht Und Ihre Retention in Der Gestauten Ruhr),
W83-02587 2J

RIVERS
Computation of Flow Patterns in Rivers,
W83-02692 2E

Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

ROCK EXCAVATION
Hydro-Fracturing at Helms,
W83-02539 8A

Surge Chamber Design for Jukla,
W83-02572 8E

Rock Engineering Investigation and Design Studies for the Drakensberg Pumped Storage Scheme,
W83-02644 8E

Construction of the Main Civil Works of the Drakensberg Pumped Storage Scheme,
W83-02665 8A

ROCK FOUNDATIONS
Current Requirements Imposed on the Contact of Gravity and Buttress Dams with Rock Foundations,
W83-02595 8E

ROCK MECHANICS
Instrumenting Australia's Cethana Dam,
W83-02603 8A

Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

Monitoring Dams and Their Foundations,
W83-02629 8D

ROCKFILL DAMS
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

Norwegian Practice in Instrumenting Dams,
W83-02630 8G

ROCKS
Rock Balls at Folsom Dam, California,
W83-02661 8F

ROTATING BIOLOGICAL CONTACTORS
Field Performance of RBC'S.
W83-02533 5D

The Scale-Up and Limitation of Physical Oxygen Transfer in Rotating Biological Contactors,
W83-02750 5D

Obtaining Secondary Treatment with RBC/Underflow Clarifiers,
W83-02753 5D

Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

RUNOFF
Responsibility for Runoff Control,
W83-02467 6E

SAFETY
Norwegian Practice in Instrumenting Dams,
W83-02630 8G

Safety Monitoring of Concrete Dams,
W83-02632 8F

SAINT LUCIA
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

SALINE LAKES
Physico-Chemical Study of Dead Sea Water, II. Density Measurements and Equation of State of Dead Sea Water at 1 ATM,
W83-02464 2H

SALINE SEEPS
Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

SALINE WATER
Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

SALMON
The Influence of Kokanee Salmon and Man on the Water Quality of Lower McDonald Creek, Glacier National Park, Montana,
W83-02494 5C

SALTATION
Saltation in Water Dynamics,
W83-02679 8B

SALTCEDAR
Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

SALTS
Physico-Chemical Study of Dead Sea Water, II. Density Measurements and Equation of State of Dead Sea Water at 1 ATM,
W83-02464 2H

Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

SAMPLERS
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

SAND FILTERS
Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

SAND FILTERS

Slow Sand Filtration for Cercarial Control in North Cameroon Village Water Supply,
W83-02790 5F

SANITATION

Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

SAPROPHYTIC BACTERIA

Investigations on Seasonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

SAUDI ARABIA

World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

SCENEDESMUS

Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

SCHISTOSOMIASIS

Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

SCUD

Uptake, Depuration and Biotransformation of Anthracene by the Scud Pontoporeia Hoyi,
W83-02549 5B

SEALANTS

Improving the Speed of Shotcrete Setting,
W83-02537 8G

SEAS

Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

Large-Scale Development of Cerataulina Bergonii Perag in the Northwestern Part of the Black Sea,
W83-02602 5C

SEASONAL VARIATION

Turbidity and its Causes in a Narrow Glacial Lake With Winter Ice Cover,
W83-02470 2H

Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

Lake Fidler, a Meromictic Lake in Tasmania,
W83-02557 2H

The Seasonal Variation of Organic Constituents in a Eutrophic Lake, Lake Suwa, Japan. Part 1, Particulate Organic Matter,
W83-02559 5C

Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

Investigations on Seasonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

SEASONAL VARIATIONS

The Effect on Storm Runoff Response of Seasonal Variations in Contributing Zones in Small Watersheds,
W83-02779 2A

SECONDARY WASTEWATER TREATMENT

Detection of Potential Carcinogens and Toxicants in Tap and Reclaimed Water by the Golden Hamster Cell Transformation Assay,
W83-02460 5A

Electroflotation Purifies Chemical Wastewater (Elektroflotation Reinigt Chemieabwasser),
W83-02508 5D

SEDIMENT CORES

Polychlorinated Biphenyls in the Sediments of the Inner Oslofjord,
W83-02783 5B

SEDIMENT GRADING

Estimation of the Size and Roughness of Sediments in Hydraulic Calculations,
W83-02622 8B

SEDIMENT TRANSPORT

Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

Sediment Deposition in a Flood-Retention Structure After Two Record Floods in Southwestern Wisconsin,
W83-02705 4D

Lateral Bed Load Transport on Side Slopes,
W83-02709 8B

SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

SEDIMENT-WATER INTERFACES

Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

SEDIMENT YIELD

The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

SEDIMENTATION

Land-Use and Management Problems in the Nile Delta,
W83-02462 6G

Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

Initial Sedimentation of Waste Particulates Discharged From Ocean Outfalls,
W83-02565 5B

Case History of Sedimentation at Peligre Dam, Haiti (Cas Historique de Sedimentation du Barrage Peligre, Haiti),
W83-02611 2J

Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

SEDIMENTS

Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

SELENIUM

Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

SELF-PURIFICATION

Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

SEMI PERMEABLE MEMBRANES

Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

SEMIPERMEABLE MEMBRANES

Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

SEPARATION TECHNIQUES

Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

Determination of Radium-228 in Foods and Water,
W83-02686 5A

Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

The Isolation of Bacteriophages from the Environment,
W83-02708 5A

Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

SESTON DRY MATTER

Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

SEWAGE RATE
Rate Structure Alternatives for Utilities,
W83-02473 6C

SEWER SYSTEMS
Flushing and Shutoff Devices for Sewers (Spul- und Absperrorgane fur Abwasserkanale),
W83-02619 5D

SHALE MEMBRANE FILTRATION
Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

SHOTCRETE
Improving the Speed of Shotcrete Setting,
W83-02537 8G

SILICA
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

SILTING
Case History of Sedimentation at Peligre Dam, Haiti (Cas Historique de Sedimentation du Barrage Peligre, Haiti),
W83-02611 2J

SLOPES
Modeling Sediment Deposition Behind Corn Residue,
W83-02455 4D

The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

SLUDGE
Wastewater Sludge Disinfection With Gamma-Rays: An Overview (Klarschlammhygienisierung Mit Gamma-Strahlen: Ein Uberblick),
W83-02505 5D

Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

The Use of Rheology for Sludge Characterization,
W83-02757 5D

Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

Fate of Heavy Metals and Potential For Clinker Formation During Pilot Scale Incineration of Municipal Sludge,
W83-02789 5E

SLUDGE CONDITIONING
A New Configuration of the High-Lime Process with Sludge Recirculation for Magnesium Recycling,
W83-02751 5D

SLUDGE DIGESTION
A Process for the Biological Disinfection of Sludge (Ein Verfahren Zur Biologischen Hygienisierung Von Klarschlamm),
W83-02507 5D

Aerobic Thermophilic Digestion of Sewage Sludge,
W83-02568 5E

Wastewater System Improvements Help Dallas Meet Future Needs,
W83-02771 5D

SLUDGE DISPOSAL
Sludge Disposal in Southern California Basins,
W83-02527 5E

Priority Pollutants in Municipal Sewage Sludge,
W83-02552 5E

Initial Sedimentation of Waste Particulates Discharged From Ocean Outfalls,
W83-02565 5B

Biomass of Marine Macrofauna Communities in a Dumping Area of Sewage Sludge Near the Elbe Estuary (Die Biomasse Mariner Makrobenthos-Gesellschaften im Bemundung),
W83-02627 5C

SLUDGE THICKENING
Thickening and Biological Disinfection of Wastewater Sludge by Submersed Rotation Aeration (Eindickung Und Biologische Entseuchung Von Abwasserschlamm Durch Submerse Umwalzbeluftung),
W83-02506 5D

SNOW COVER
Identification of Snowcover Depletion Patterns Using Satellite Imagery,
W83-02488 2C

SNOW DEPTH
Measurement and Modeling of Microwave Emission from Forested Snowfields in Michigan,
W83-02774 2C

SNOW MANAGEMENT
The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

SNOWCOVER
Areal Differentiation of Land and Lake Snowcover in a Small Sub-Arctic Drainage Basin,
W83-02775 2C

SOCIAL IMPACT
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

SOIL CHEMISTRY
Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

SOIL CONTAMINATION
Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

SOIL MOISTURE
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

Automatic Tensiometer Scanner for Rapid Measurements,
W83-02458 7B

Estimation of Soil Water Properties,
W83-02459 2G

SOIL-MOISTURE TRANSPORT
Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

SOIL PHYSICAL PROPERTIES
Estimation of the Size and Roughness of Sediments in Hydraulic Calculations,
W83-02622 8B

SOIL PROPERTIES
Estimation of Soil Water Properties,
W83-02459 2G

Effect of Subterranean Drainage on Some Properties of Clay Soils in Quebec (Effet du Drainage Souterrain Sur Quelques Proprietes de Sols Argileux du Quebec),
W83-02613 2G

SOIL TYPES
Effect of Soil and Coniferous Trees on Some Chemical Characteristics of the Water of Reservoir LG2 (Influence Des Sols Et Arbres Noyes Sur Quelques Caracteristiques Chimiques De L'Eau Du Reservoir LG2),
W83-02520 5B

SOIL WATER
Drainage Coefficients,
W83-02454 4A

SOIL WATER TABLE
Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

SOLAR RADIATION
The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

SOLUBILITY
Salting-Out of Methane in Single-Salt Solutions at 25 Degrees C and Below 800 PSIA,
W83-02583 2K

A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

SOLUTE TRANSPORT
Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

SOLUTES
Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

SOLUTIONS
The Hydrophobic Interaction Is Long Range, Decaying Exponentially with Distance,
W83-02778 1B

SORGHUM
The Adaptation of Varieties of Sorghum to Different Water Regimes,
W83-02612 2I

SORPTION
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

SOUTH AFRICA
The Sea Effluent Pipeline - Environmental Blunder or Socio-Economic Boon.
W83-02517 5E

The Design of Drakensberg,
W83-02541 8A

The Construction of the Tugela-Vaal Project Dams,
W83-02643 8A

Rock Engineering Investigation and Design Studies for the Drakensberg Pumped Storage Scheme,
W83-02644 8E

SOUTH AFRICA

The Drakensberg Project: Water and Power for South Africa,
W83-02647 6D

The Dams of the Tugela-Vaal Project,
W83-02648 8A

Environmental Considerations of the Drakensberg Pumped Storage Scheme,
W83-02664 6G

Construction of the Main Civil Works of the Drakensberg Pumped Storage Scheme,
W83-02665 8A

The Sterkfontein Dam Outlet Works,
W83-02666 8A

Aspects of the Machine Foundation Design at Drakensberg,
W83-02667 8C

Concrete Waterway Linings for the Drakensberg Pumped Storage Scheme,
W83-02668 8F

The Drakensberg Pumped Storage Scheme Description of Scheme and Principal Data,
W83-02671 8A

SOUTH CAROLINA

Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

SPAIN

Unique Design for Guijo De Granadilla,
W83-02538 8C

Estimation of the Sewage Loading of the Mediterranean at the Beaches of Valencia, Spain (Estimacion de la Carga Contaminante Vertida al Mar Mediterraneo en el Litoral Proximo a la Ciudad de Valencia (Espana)),
W83-02796 5B

SPECTROPHOTOMETRY

Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

SPECTROSCOPY

Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

SPILLWAYS

Spillway Aeration of the San Roque Project,
W83-02540 8B

Multistage Whirlpool Shaft Spillways,
W83-02597 8A

ST. LAWRENCE RIVER

Evaluation of Organochlorine Contents in the Saint Lawrence River, Estuary and Gulf, Canada (Evaluation Des Teneurs En Composes Organochlores Dans Le Fleuve, L'Estuaire Et Le Golfe Saint-Laurent, Canada),
W83-02578 5B

STABILITY

Seismic Safety Analysis of Lower Crystal Springs Dam: A Case History,
W83-02663 8E

STANDARDS

Water Chemicals Codex,
W83-02546 5F

Survey of Polyelectrolyte Coagulant Use in the United States,
W83-02691 5F

STATISTICAL METHODS

Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

STATISTICS

The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

STEAM DISTILLATION METHOD

Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

STILLING BASINS

The Sterkfontein Dam Outlet Works,
W83-02666 8A

STOCHASTIC PROCESS

More Confidence in Planning Through Capacity Standards for Water Supply Systems (Mehr Planerische Sicherheit Durch Die Ableitung Von Kapazitatsbemessungsgrund Lagen Fur Die Wasserwirtschaft),
W83-02763 6D

STORAGE CAPACITY

Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

STORAGE COEFFICIENT

Ground-Water Recharge Rates in Minnesota as Related to Precipitation,
W83-02730 2F

STORAGE RESERVOIRS

Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

STORAGE TANKS

Keeping Clean Water Clean,
W83-02780 5F

STORM DRAINS

Design and Analysis of Urban Storm Drainage - The Wallingford Procedure,
W83-02550 2A

STORM RUNOFF

Design and Analysis of Urban Storm Drainage - The Wallingford Procedure,
W83-02550 2A

The Effect on Storm Runoff Response of Seasonal Variations in Contributing Zones in Small Watersheds,
W83-02779 2A

STORM WASTEWATER

Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

STORM WATER

Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

Responsibility for Runoff Control,
W83-02467 6E

STREAM POLLUTION

Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

STREAMS

Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

Diurnal Variations in Electrical Conductivity of Water in a Small Stream,
W83-02776 2K

STRESS

Instrumenting Australia's Cethana Dam,
W83-02603 8A

Safety Monitoring of Concrete Dams,
W83-02632 8F

STRIP MINES

Symposium on Surface Coal Mining and Reclamation in the Northern Great Plains, an Update on Mine Spoils Hydrology Southeastern Montana,
W83-02495 2F

STRONTIUM

90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

SUBSTRATES

Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

SUGARCANE

Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

SULFIDES

The Potentiometric Titration of Sulfide in Wastewater Using A Sensitive Electrode (Die Potentiometrische Titration Von Sulfid in Abwasser Mit Hilfe Einer Sensitiven Elektrode),
W83-02639 5A

SUNFISH

Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

SURFACE-GROUNDWATER RELATIONS

Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

SURFACE RUNOFF

The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

SURFACE WATER

The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

SURFACE WATERS

The Occurrence of PCH3-Containing Compounds in Surface Waters,
W83-02518 5A

SURFACTANTS

Persistent Organic Chemicals in Sewage Effluents. 2. Quantitative Determinations of Nonylphenols and Nonylphenol Ethoxylates by Glass Capillary Gas Chromatography,
W83-02529 5A

SURGE CHAMBERS

Surge Chamber Design for Jukla,
W83-02572 8E

SURGES

Surges of Finite Height,
W83-02631 8B

SURVEYS

Recreation in the Perceived Community Function Perspective,
W83-02740 6B

SUSPENDED SOLIDS
Significance of River Flow for the Suspended Solids Burden and its Retention in the Impounded Ruhr (Bedeutung Des Abflusses Fur Die Schwebstofffracht Und Ihre Retention in Der Gestauten Ruhr),
W83-02587 2J

SWEDEN
Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

Diurnal Variations in Electrical Conductivity of Water in a Small Stream,
W83-02776 2K

SWITZERLAND
The Expansion of the Uster Wastewater Treatment Facility--Fourth Treatment Stage--Wastewater Filtration Facility (Die Erweiterung Der Klaranlage Uster, 4. Reinigungsstuffe, Abwasswerfiltrationsanlage).
W83-02503 5D

The Rotsee - An Example of a Lake in Which Water Pollution Control Measures Were Successful (Der Rotsee - Ein Beispiel fur Einen See, Bei Dem Die Gewasserschutzmassnahmen Erfolge Brachten),
W83-02504 5G

Restoration of the Central Lakes: Baldeggersee, Hallwilersee, and Sempachersee. General Overview (Die Sanierung Dermittellandseen: Baldeggersee, Hallwilersee Und Sempachersee. Allgemeiner Uberblick),
W83-02558 5G

Further Action by the Cantons. Aargau Canton (Das Weitere Vorgehen Der Kantone. Kanton Aargau),
W83-02758 5G

Further Action by the Cantons. Lucerne Canton (Das Weitere Vorgehen Der Kantone. Kanton Luzern),
W83-02759 5G

Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

Hydroelectric Power Utilization and Environmental Protection (Wasserkraftnutzung Und Umweltschutz),
W83-02788 6G

TASMANIA
Lake Fidler, a Meromictic Lake in Tasmania,
W83-02557 2H

TASTE
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

TEMPERATURE
Ozonalysis for Water Reuse Applications,
W83-02498 5F

Weekly Water Use Estimates by Crops and Natural Vegetation in Indiana,
W83-02739 2D

TEMPERATURE GRADIENTS
Thermohaline Convection in a Nonhomogeneous Aquifer,
W83-02675 2F

TENNESSEE
Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

TENSIOMETERS
Automatic Tensiometer Scanner for Rapid Measurements,
W83-02458 7B

TERTIARY WATER TREATMENT
Continuous Countercurrent Ion Exchange for Desalination and Tertiary Treatment of Effluents and Other Brackish Waters,
W83-02792 3A

TETON DAM
Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

TEXAS
Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

Wastewater System Improvements Help Dallas Meet Future Needs,
W83-02771 5D

THE GEYSERS KGRA
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

THE NETHERLANDS
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

THEORETICAL ANALYSIS
Safety Monitoring of Concrete Dams,
W83-02632 8F

THERMAL DISCHARGES
Cooling Systems: Can Engineers Save the Fish,
W83-02551 8I

THERMAL SPRINGS
The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

THERMOHALINE CONVECTION
Application of the Aquifer's Average Characteristics for Determining the Onset of Thermohaline Convection in a Heterogeneous Aquifer,
W83-02674 2F

Thermohaline Convection in a Nonhomogeneous Aquifer,
W83-02675 2F

THORNTHWAITE METHOD
Weekly Water Use Estimates by Crops and Natural Vegetation in Indiana,
W83-02739 2D

TIDAL FLATS
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

TIDAL WAVES
Tidal Wave Analysis for Estuaries with Intertidal Flats,
W83-02637 2L

TIME SERIES ANALYSIS
Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

TISSUE ANALYSIS
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

TITRATION
The Potentiometric Titration of Sulfide in Wastewater Using A Sensitive Electrode (Die Potentiometrische Titration Von Sulfid in Abwasser Mit Hilfe Einer Sensitiven Elektrode),
W83-02639 5A

TOTAL ORGANIC CARBON
Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

TOXICITY
Nickel Toxicity to Fungi: Influence of Environmental Factors,
W83-02582 5C

Toxic Substances Monitoring Program - 1981,
W83-02719 5A

TRACE ELEMENTS
Trace Elements in Tissues of Commercial Fish From Lake Ladoga,
W83-02598 5B

90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

TRACE METALS
Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

Toxic Substances Monitoring Program - 1981,
W83-02719 5A

TRAINING
Effective Start-Up Training for Wastewater Treatment Plants,
W83-02772 5D

TRANSPORT NUMBER
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

TRICHLOROETHYLENE
Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

TRIHALOMETHANE
Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

TRIHALOMETHANES
Technical Note: Removing Trihalomethane Formation Potential by Coagulation With Activated Silica and Cationic Polymer,
W83-02681 5F

TRITIUM ANALYSIS
Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

TROPHIC LEVEL
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

TROUT
Hemoglobin-Glutathione Relationships in Trout Erythrocytes Treated With Monochloramine,
W83-02660 5C

TUBE TURBINES
Experience Curves for Feasibility Studies and Planning of Modern Low-Head Hydro Turbines,
W83-02489 8C

TUNNEL LININGS
Concrete Waterway Linings for the Drakensberg Pumped Storage Scheme,
W83-02668 8F

TUNNELS
Multistage Whirlpool Shaft Spillways,
W83-02597 8A

Rock Engineering Investigation and Design Studies for the Drakensberg Pumped Storage Scheme,
W83-02644 8E

Construction of the Main Civil Works of the Drakensberg Pumped Storage Scheme,
W83-02665 8A

TURBIDITY
Turbidity and its Causes in a Narrow Glacial Lake With Winter Ice Cover,
W83-02470 2H

TURBINES
Experience Curves for Feasibility Studies and Planning of Modern Low-Head Hydro Turbines,
W83-02489 8C

Developments in Pump-Turbines,
W83-02536 8C

Unique Design for Guijo De Granadilla,
W83-02538 8C

Improvement of the Power Output of Hydroelectric Plants (Verbesserung Der Leistungsfahigkeit Von Wasserkraftwerken),
W83-02800 8C

ULTRAFILTRATION
Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

The Isolation of Bacteriophages from the Environment,
W83-02708 5A

ULTRAVIOLET RADIATION
High Purity Water Using H202 and UV Radiation,
W83-02531 5F

UNDERGROUND STRUCTURES
Rock Engineering Investigation and Design Studies for the Drakensberg Pumped Storage Scheme,
W83-02644 8E

Construction of the Main Civil Works of the Drakensberg Pumped Storage Scheme,
W83-02665 8A

Aspects of the Machine Foundation Design at Drakensberg,
W83-02667 8C

Concrete Waterway Linings for the Drakensberg Pumped Storage Scheme,
W83-02668 8F

UNITED ARAB EMIRATES
Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

Operation of Meff Desalination Plant (Multiple Effect Falling Film Process),
W83-02525 3A

UNITED KINGDOM
Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

URANIUM
Behavior of Uranium in Two Estuaries of the Southeastern United States,
W83-02465 2L

URBAN DRAINAGE
Design and Analysis of Urban Storm Drainage - The Wallingford Procedure,
W83-02550 2A

URBAN RUNOFF
Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

USER CHARGES
Rate Structure Alternatives for Utilities,
W83-02473 6C

USSR
Embankment Dams of Paz Cascade of Hydropower Stations and Some Conclusions From Their Operational Experience,
W83-02593 8E

Overflow Road Crossing Across the Dnestr River at the Construction Site of the Dnestr Hydrostation,
W83-02594 8A

Multistage Whirlpool Shaft Spillways,
W83-02597 8A

Trace Elements in Tissues of Commercial Fish From Lake Ladoga,
W83-02598 5B

Acid-Base Equilibrium During Photosynthesis in Water,
W83-02600 2K

Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

Large-Scale Development of Cerataulina Bergonii Perag in the Northwestern Part of the Black Sea,
W83-02602 5C

Deposition of Sediments on Thicket-Covered Flood Plain,
W83-02605 2J

Interaction of Large Hydraulic Engineering Systems with the Environment,
W83-02606 6G

Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

UTAH
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

UTILITIES
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

VALVES
Maintaining Distribution System Valves and Fire Hydrants,
W83-02714 8C

Valve and Hydrant Maintenance,
W83-02782 5F

VEGETATION
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

VEGETATION EFFECTS
Deposition of Sediments on Thicket-Covered Flood Plain,
W83-02605 2J

VELOCITY
Thin Slender Water Jets,
W83-02677 8B

VIRUSES
Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

The Isolation of Bacteriophages from the Environment,
W83-02708 5A

VOLATILITY
Fate of Acetone in Water,
W83-02645 5B

VOLCANOES
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

WALES
Quantifying Source Areas Through Land Surface Curvature and Shape,
W83-02702 2E

The Populations, Characterization and Activity of Suspended Bacteria in the Welsh River Dee,
W83-02707 5B

WASHINGTON
Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

WASTE DUMPS
The Role of Bentonite in Soil Sealing Applications,
W83-02662 5G

WASTEWATER ANALYSIS
Measuring Chlorine Dioxide With a Rotating Voltammetric Membrane Electrode.
W83-02682 5A

WASTEWATER DISPOSAL
Agricultural Use of Sugar Refinery Wastewater Change in Mineral Nitrogen in Soils Used for Landspreading (Valorisation Agricole Des Effluents En Sucrerie, Etude De L' Evolution De L' Azote Mineral Dans Les Sols Soumis Aux Epandages),
W83-02633 3C

WASTEWATER FACILITIES
The Expansion of the Uster Wastewater Treatment Facility--Fourth Treatment Stage--Wastewater Filtration Facility (Die Erweiterung Der Klaranlage Uster, 4. Reinigungsstuffe, Abwasswerfiltrationsanlage).
W83-02503 5D

WASTEWATER OUTFALL
The Sea Effluent Pipeline - Environmental Blunder or Socio-Economic Boon.
W83-02517 5E

WASTEWATER OXIDATION
Practical Determination of the First Stage BOD of Sewage,
W83-02581 5A

WASTEWATER TREATMENT
The Effect of Chlorine Dioxide Substitution in the First Stage of Pulp Bleaching on Bleach Plant Effluent BOD,
W83-02469 5D

Ozonalysis for Water Reuse Applications,
W83-02498 5F

The Expansion of the Uster Wastewater Treatment Facility--Fourth Treatment Stage--Wastewater Filtration Facility (Die Erweiterung Der Klaranlage Uster, 4. Reinigungsstuffe, Abwasswerfiltrationsanlage).
W83-02503 5D

The Rotsee - An Example of a Lake in Which Water Pollution Control Measures Were Successful (Der Rotsee - Ein Beispiel fur Einen See, Bei Dem Die Gewasserschutzmassnahmen Erfolge Brachten),
W83-02504 5G

Wastewater Sludge Disinfection With Gamma-Rays: An Overview (Klarschlammhygienisierung Mit Gamma-Strahlen: Ein Uberblick),
W83-02505 5D

Thickening and Biological Disinfection of Wastewater Sludge by Submersed Rotation Aeration (Eindickung Und Biologische Entseuchung Von Abwasserschlamm Durch Submerse Umwalzbeluftung),
W83-02506 5D

A Process for the Biological Disinfection of Sludge (Ein Verfahren Zur Biologischen Hygienisierung Von Klarschlamm),
W83-02507 5D

Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

Interactions Between Amino-Acid-Degrading Bacteria and Methanogenic Bacteria in Anaerobic Digestion,
W83-02515 5D

Industrial Effluent Control Experience,
W83-02530 5D

Field Performance of RBC'S.
W83-02533 5D

Aerobic Thermophilic Digestion of Sewage Sludge,
W83-02568 5E

The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

Treatment of Unusual Inorganic Wastes,
W83-02580 5D

Practical Determination of the First Stage BOD of Sewage,
W83-02581 5A

Economics of Precipitant Use in Municipal Wastewater Treatment Plants (Wirtschaftlichkeit Des Fallmitteleinsatzes in Kommunalen Klaranlagen),
W83-02591 5D

Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

Engineers Assess Aquaculture Systems For Wastewater Treatment - Part II,
W83-02649 5D

Start-Up and Operation of an Oxygen-Activated Advance Wastewater Treatment System,
W83-02680 5D

Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

Biological Nitrification in an Up Flow Fixed Bed Reactor (UFBR),
W83-02747 5D

Mass-Transfer Characteristics Within Microbial Systems,
W83-02749 5D

The Scale-Up and Limitation of Physical Oxygen Transfer in Rotating Biological Contactors,
W83-02750 5D

A New Configuration of the High-Lime Process with Sludge Recirculation for Magnesium Recycling,
W83-02751 5D

Effect of Denitrification on the pH in Biofilms,
W83-02752 5D

Obtaining Secondary Treatment with RBC/Underflow Clarifiers,
W83-02753 5D

Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

The Use of Rheology for Sludge Characterization,
W83-02757 5D

Wastewater System Improvements Help Dallas Meet Future Needs,
W83-02771 5D

Effective Start-Up Training for Wastewater Treatment Plants,
W83-02772 5D

Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chasticlino Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

Application of the Marais - Ekama Activated Sludge Model to Large Plants,
W83-02791 5E

WASTEWATER TREATMENT FACILITIES
Electroflotation Purifies Chemical Wastewater (Elektroflotation Reinigt Chemieabwasser),
W83-02508 5D

WASTEWATER TREATMENT PONDS
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

WATER ALLOCATION
Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

WATER ALLOCATION (POLICY)
The Economic Impacts of Alternatives and Contingencies Relating to the 1978 Decisions of the Montana Board of Natural Resources on Water Reservations in the Yellowstone Basin,
W83-02493 6B

WATER ANALYSIS
The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

Measuring Chlorine Dioxide With a Rotating Voltammetric Membrane Electrode.
W83-02682 5A

Determination of Radium-228 in Foods and Water,
W83-02686 5A

Simple Paper Chromatographic Method ror Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

WATER AVAILABILITY
Estimation of Soil Water Properties,
W83-02459 2G

Cotton Growth Related to Plant's Water Status,
W83-02576 3F

WATER CIRCULATION
The Effects of Limnological Processes on the Quality of Impounded Waters (Auswikungen Limnologischer Vorgange Auf Die Beschaffenheit Von Staugewassern),
W83-02784 2H

WATER CONSERVATION
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

WATER CONSERVATION

An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

WATER CONSUMPTION

Computer-Based Telemetry Monitors Water Use,
W83-02794 5F

WATER CONVEYANCE

Seeking Consumers Cooperation in the Financing of Water Supply (Conditions Permettant Aux Consommateurs A Ressources Limitees De Participer Au Financement De Leur Consommation D Eau),
W83-02634 6C

Drinking Water and Its Pricing (Eau Potable et Tarification),
W83-02652 6C

WATER COSTS

Rate Structure Alternatives for Utilities,
W83-02473 6C

The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

Drinking Water and Its Pricing (Eau Potable et Tarification),
W83-02652 6C

WATER DELIVERY

The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

WATER DEMAND

The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

More Confidence in Planning Through Capacity Standards for Water Supply Systems (Mehr Planerische Sicherheit Durch Die Ableitung Von Kapazitatsbemessungsgrund Lagen Fur Die Wasserwirtschaft),
W83-02763 6D

WATER DISTRIBUTION

Drinking Water and Its Pricing (Eau Potable et Tarification),
W83-02652 6C

Maintaining Aging Systems - Boston's Approach,
W83-02689 5F

Aquatic Invaders,
W83-02766 5F

Computer Assisted Analysis to Improve Water System Operation,
W83-02799 5F

WATER DISTRIBUTION *MAINTENANCE

Maintaining Distribution System Valves and Fire Hydrants,
W83-02714 8C

WATER EXCHANGE

Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

WATER LAW

Make Applications According to the State Wastewater Tax Laws on Time (Die Antrage Nach Den Landes-Abwasserabgabengesetzen Rechtzeitig Stellen),
W83-02786 6E

WATER MAINS

Organizing and Analyzing Leak and Break Data for Making Main Replacement Decisions,
W83-02712 5F

WATER MANAGEMENT

Urgent Problems of Conservation and Rational Use of Water Resources,
W83-02623 5G

Drinking Water and Its Pricing (Eau Potable et Tarification),
W83-02652 6C

WATER POLICY

The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

WATER POLLUTION

Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

Evaluatiєn of Organochlorine Contents in the Saint Lawrence River, Estuary and Gulf, Canada (Evaluation Des Teneurs En Composes Organochlores Dans Le Fleuve, L'Estuaire Et Le Golfe Saint-Laurent, Canada),
W83-02578 5B

The Effects of Limnological Processes on the Quality of Impounded Waters (Auswikungen Limnologischer Vorgange Auf Die Beschaffenheit Von Staugewassern),
W83-02784 2H

WATER POLLUTION CONTROL

The Rotsee - An Example of a Lake in Which Water Pollution Control Measures Were Successful (Der Rotsee - Ein Beispiel fur Einen See, Bei Dem Die Gewasserschutzmassnahmen Erfolge Brachten),
W83-02504 5G

Restoration of the Central Lakes: Baldeggersee, Hallwilersee, and Sempachersee. General Overview (Die Sanierung Dermittellandseen: Baldeggersee, Hallwilersee Und Sempachersee. Allgemeiner Uberblick),
W83-02558 5G

The Role of Bentonite in Soil Sealing Applications,
W83-02662 5G

Make Applications According to the State Wastewater Tax Laws on Time (Die Antrage Nach Den Landes-Abwasserabgabengesetzen Rechtzeitig Stellen),
W83-02786 6E

WATER POLLUTION EFFECTS

Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

WATER POLLUTION SOURCES

Parameters of Deteriorating Microbiological Quality of Selected Surface Waters in Residential Missoula, Montana,
W83-02492 5B

The Influence of Kokanee Salmon and Man on the Water Quality of Lower McDonald Creek, Glacier National Park, Montana,
W83-02494 5C

The Occurrence of PCH3-Containing Compounds in Surface Waters,
W83-02518 5A

Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

The Populations, Characterization and Activity of Suspended Bacteria in the Welsh River Dee,
W83-02707 5B

Contamination of the Mediterranean Coast and its Control as a Problem of Land Management (La Contaminacion Litoral Mediterranea Y su Correccion Como un Problema De La Ordenacion Territorial),
W83-02777 5B

Estimation of the Sewage Loading of the Mediterranean at the Beaches of Valencia, Spain (Estimacion de la Carga Contaminante Vertida al Mar Mediterraneo en el Litoral Proximo a la Ciudad de Valencia (Espana)),
W83-02796 5B

WATER PURIFICATION

Anodic Oxidation for Drinking Water Disinfection, Part 1: Bacteriologic Studies in Practical Use (Anodische Oxydation Trinkwasserdesinfektion, 1. Mitteilug: Bakteriologische Untersuchungen Bei Praxiseinsatz),
W83-02588 5F

WATER QUALITY

The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

Attacking Odors with H202,
W83-02765 5F

Keeping Clean Water Clean,
W83-02780 5F

The Effects of Limnological Processes on the Quality of Impounded Waters (Auswikungen Limnologischer Vorgange Auf Die Beschaffenheit Von Staugewassern),
W83-02784 2H

WATER QUALITY CONTROL

Effluent Limitations Based on Water Quality,
W83-02466 5E

WATER QUALITY DATA

Toxic Substances Monitoring Program - 1981,
W83-02719 5A

WATER QUALITY STANDARDS

Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

WATER RATES
Much More to Rates Than Tradition,
W83-02781 6C

WATER RESEARCH INSTITUTES
Water Resources Research Coordination and Planning in the Colorado River-Great Basin Region,
W83-02744 9D

WATER RESOURCES DEVELOPMENT
The Crest Dispute: A Mediation Success,
W83-02532 6D

Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

Interaction of Large Hydraulic Engineering Systems with the Environment,
W83-02606 6G

Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

Improvement of the Power Output of Hydroelectric Plants (Verbesserung Der Leistungsfahigkeit Von Wasserkraftwerken),
W83-02800 8C

WATER RESOURCES MANAGEMENT
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

WATER REUSE
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

Ozonalysis for Water Reuse Applications,
W83-02498 5F

Urgent Problems of Conservation and Rational Use of Water Resources,
W83-02623 5G

Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

WATER SAMPLING
Toxic Substances Monitoring Program - 1981,
W83-02719 5A

WATER SCARCITY
The Hundred-Year Effort to Secure Hong Kong's Water Supply (Hundertjahriges Bemuhen um Hong Kong's Wasserversorgung),
W83-02762 3B

WATER SUPPLY
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

The Drakensberg Project: Water and Power for South Africa,
W83-02647 6D

Quantifying Source Areas Through Land Surface Curvature and Shape,
W83-02702 2E

More Confidence in Planning Through Capacity Standards for Water Supply Systems (Mehr Planerische Sicherheit Durch Die Ableitung Von Kapazitatsbemessungsgrund Lagen Fur Die Wasserwirtschaft),
W83-02763 6D

WATER SUPPLY DEVELOPMENT
Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

The Hundred-Year Effort to Secure Hong Kong's Water Supply (Hundertjahriges Bemuhen um Hong Kong's Wasserversorgung),
W83-02762 3B

WATER TANKS
Inspecting, Painting, and Maintaining Steel Water Tanks,
W83-02713 8G

WATER TEMPERATURE
Experience in Predicting Elements of the Ice and Thermal Regime of the Lower Pools of Hydroelectric Stations
W83-02621 2C

Investigations on Sessonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

Surface Temperature Model for Evaporation Pans (Modelisation De La Temperature De Surface Des Bacs Evaporometriques),
W83-02673 2D

WATER TREATMENT
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

A Small Facility for the Ozone Treatment of Water (Kleinanlage Zur Ozonbehandlung Von Wasser),
W83-02509 5F

Formation and Removal of Mutagenic Activity in Drinking Water by Ozonisation,
W83-02510 5F

The Degree of Utilization of Anion Exchange Filters in Nitrate Removal From Drinking Water (Ausnutzungsgrad Von Anionenaustauschfiltern Bei Der Nitratentfernung Aus Trinkwassern),
W83-02512 5F

High Purity Water Using H202 and UV Radiation,
W83-02531 5F

Decomposition of Ozone in Water: Rate of Initiation by Hydroxide Ions and Hydrogen Peroxide,
W83-02577 5F

Anodic Oxidation for Drinking Water Disinfection, Part 1: Bacteriologic Studies in Practical Use (Anodische Oxydation Trinkwasserdesinfektion, 1. Mitteilug: Bakteriologische Untersuchungen Bei Praxiseinsatz),
W83-02588 5F

Anodic Oxidation for Drinking Water Disinfection, Part II: Studies on Haloform Formation (Anodische Oxidation Zur Trinkwasserdesinfektion, II. Mitteilung: Untersuchungen Zur Haloformbildung),
W83-02589 5F

Conventional, Upflow, and Radial Filters: Comparison and Mathematical Modelling,
W83-02615 5F

Technical Note: Removing Trihalomethane Formation Potential by Coagulation With Activated Silica and Cationic Polymer,
W83-02681 5F

Survey of Polyelectrolyte Coagulant Use in the United States,
W83-02691 5F

Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

WATER TREATMENT CODEX
Water Chemicals Codex,
W83-02546 5F

WATER TREATMENT FACILITIES
A Small Facility for the Ozone Treatment of Water (Kleinanlage Zur Ozonbehandlung Von Wasser),
W83-02509 5F

Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

WATER USE
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

Weekly Water Use Estimates by Crops and Natural Vegetation in Indiana,
W83-02739 2D

WATER USE EFFICIENCY
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

WATER VALUE
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

WATER YIELD
The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

WATER YIELD IMPROVEMENT
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield

Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

WATERSHED MANAGEMENT
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

WATERSHEDS
The Effect on Storm Runoff Response of Seasonal Variations in Contributing Zones in Small Watersheds,
W83-02779 2A

WAVE PROPAGATION
Numerical Convolution for Solution of Wave Propagation Problems: Filter Scheme Methods,
W83-02672 8B

WAVES
Waves on Glaciers,
W83-02699 2C

WEED CONTROL
Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

WELLS
Well Hydraulics in Vertically Heterogeneous Formations,
W83-02693 2F

WETTING
Use of Similarity Solutions for the Problem of A Wetting Front - A Question of Unique Representation,
W83-02638 2G

WISCONSIN
Sediment Deposition in a Flood-Retention Structure After Two Record Floods in Southwestern Wisconsin,
W83-02705 4D

Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

X-RAY SPECTROSCOPY
Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

YAZOO BASIN
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

YUGOSLAVIA
Comparative Seasonal Uptake of Glucose and Acetate by Epiphytic Bacteria on the Surfaces of Three Species of Macrophyte in the Littoral Zone of Lake Ohrid, Yugoslavia,
W83-02556 2H

ZINC
Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

ZOOPLANKTON
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

Effects of Impoundment of Desaulniers Reservoir (James Bay Territory) on Zooplankton in a River and a String Bog. (Effets De La Mise En Eau Du Reservoir Desaulniers (Territoire De La Baie De James) Sur Le Zooplancton D'Une Riviere Et D'Une Tourbiere Reticulee),
W83-02604 6G

AUTHOR INDEX

ABDULLAH, M. I.
Polychlorinated Biphenyls in the Sediments of the Inner Oslofjord,
W83-02783 5B

ABEL, E.
Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

ADAMS, D. J.
Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

ADAMS, M. B.
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

ADAMS, W. P.
Areal Differentiation of Land and Lake Snowcover in a Small Sub-Arctic Drainage Basin,
W83-02775 2C

AKHMEDOV, T. KH.
Multistage Whirlpool Shaft Spillways,
W83-02597 8A

AL-AZAWI, S. H.
Field Determination of Infiltration Parameters (Bestimmung von Infiltrationsparametern mit Hilfe von Feldmessungen),
W83-02785 2G

ALDRICH, T. M.
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

ALEXANDER, H. C.
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

ALEXANDER, M.
Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

ALLEN, H. L.
Comparative Seasonal Uptake of Glucose and Acetate by Epiphytic Bacteria on the Surfaces of Three Species of Macrophyte in the Littoral Zone of Lake Ohrid, Yugoslavia,
W83-02556 2H

ALTHER, G. R.
The Role of Bentonite in Soil Sealing Applications,
W83-02662 5G

AMMANN, P.
Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

AMUNDSEN, C. C.
Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

ANDRESEN, A.
Norwegian Practice in Instrumenting Dams,
W83-02630 8G

ANGLIN, F. M.
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

APTE, S.
Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

ARBAB-ZAVAR, M. H.
Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

ARNOLD, J. G.
A Model for Drainage Benefits,
W83-02452 4A

ARVIN, E.
Effect of Denitrification on the pH in Biofilms,
W83-02752 5D

AUSSENAC, D.
Mathematical Model of a Mechanical Vapour Compression Evaporator. Application to Seawater Desalting. Part I-The Model Settlement,
W83-02526 3A

AVAKYAN, A. B.
Urgent Problems of Conservation and Rational Use of Water Resources,
W83-02623 5G

AYARS, J. E.
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

BABICH, H.
Nickel Toxicity to Fungi: Influence of Environmental Factors,
W83-02582 5C

BACHMAN, R.
Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

BAHNICK, D. A.
Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

BAHR, J.
Seismic Safety Analysis of Lower Crystal Springs Dam: A Case History,
W83-02663 8E

BAKER, A. J.
Analysis of a Finite Element Algorithm for Numerical Predictions in Water Resources Research,
W83-02656 8B

BAKER, D. N.
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

BALLOFFET, A.
Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

BAR-YOSEF, B.
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

BARATTA, E. J.
Determination of Radium-228 in Foods and Water,
W83-02686 5A

BARNETT, B. B.
Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

BARNETT, R. H. W.
Instrumenting Australia's Cethana Dam,
W83-02603 8A

BARRETT, B. S.
Valve and Hydrant Maintenance,
W83-02782 5F

BARTH, C. L.
Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

BARTHOLIC, J. F.
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

BARTHOLOMEW, R. K.
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

BARTLETT, E. A.
Aqueous Odor and Taste Thresbold Values of Industrial Chemicals,
W83-02684 5A

BASCO, D. R.
Numerical Convolution for Solution of Wave Propagation Problems: Filter Scheme Methods,
W83-02672 8B

BASTIAN, R. K.
Engineers Assess Aquaculture Systems For Wastewater Treatment - Part II,
W83-02649 5D

BATCHELOR, B.
Technical Note: Removing Trihalomethane Formation Potential by Coagulation With Activated Silica and Cationic Polymer,
W83-02681 5F

BATEMAN, S. T.
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

BATH, A. H.
Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

BATTEN, W. G.
Sediment Deposition in a Flood-Retention Structure After Two Record Floods in Southwestern Wisconsin,
W83-02705 4D

BAUER, T. L.
Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

BAUM, B. M.
Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

BAUMANN, P.
Further Action by the Cantons. Lucerne Canton (Das Weitere Vorgehen Der Kantone. Kanton Luzern),
W83-02759 5G

Restoration of the Central Lakes: Baldeggersee, Hallwilersee, and Sempachersee. General Overview (Die Sanierung Dermittellandseen: Baldeggersee, Hallwilersee Und Sempachersee. Allgemeiner Uberblick),
W83-02558 5G

BAVEJA, A. K.
Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

BECKE, L.
Unique Design for Guijo De Granadilla,
W83-02538 8C

BEIER, E.
Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

BELFORT, G.
Characterization of Fouling Potential for Pressure-Driven Membrane Processes: A New Simulated Flow Cell,
W83-02745 3A

BELISLE, A. A.
Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

BELL, J. S.
Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

BENDERLIEV, K. M.
Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

BENEDEK, A
Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

BERAN, M. A.
Quantifying Source Areas Through Land Surface Curvature and Shape,
W83-02702 2E

BERGH-CHRISTENSEN, J.
Surge Chamber Design for Jukla,
W83-02572 8E

BERN, J.
Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

BERNHARDT, H.
The Effects of Limnological Processes on the Quality of Impounded Waters (Auswikungen Limnologischer Vorgange Auf Die Beschaffenheit Von Staugewassern),
W83-02784 2H

BETCHART, W. B.
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

BEYER, J.
Improvement of the Accuracy of Prediction of Stochastic Models of the Oxygen Concentration in Running Waters (Verbessrung der Vorhersagegenauigkeit Stochastischer Modelle des Sauerstoffgehaltes von Fliessgewassern),
W83-02658 2E

BLACKBURN, W. H.
Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

BLAKE, B. F.
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

BOCHENIN, V. F.
90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

BOESCH, W. W.
World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

BOGERT, I. L.
Obtaining Secondary Treatment with RBC/Underflow Clarifiers,
W83-02753 5D

BOLTO, B. A.
Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

BONEV, B.
Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

BORES, P. S.
Cubelles Thermal Power Plant-A New Solution for the Intake and Discharge of Cooling Water (Centra Termica De Cubelles-Una Nueva Solucion Para la Toma Y Descarga de Agua de Refrigeracion),
W83-02795 8A

BORGAS, M. S.
Thin Slender Water Jets,
W83-02677 8B

BORNEFF, M.
Anodic Oxidation for Drinking Water Disinfection, Part 1: Bacteriologic Studies in Practical Use (Anodische Oxydation Trinkwasserdesinfektion, 1. Mitteilug: Bakteriologische Untersuchungen Bei Praxiseinsatz),
W83-02588 5F

BOSHOLM, J.
The Degree of Utilization of Anion Exchange Filters in Nitrate Removal From Drinking Water (Ausnutzungsgrad Von Anionenaustauschfiltern Bei Der Nitratentfernung Aus Trinkwassern),
W83-02512 5F

BOTER, H. L.
The Occurrence of PCH3-Containing Compounds in Surface Waters,
W83-02518 5A

BOTHWELL, P. D.
Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

BOTTCHER, A. B.
Automatic Tensiometer Scanner for Rapid Measurements,
W83-02458 7B

BRAEKKAN, O. R.
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

BRAKENSIEK, D. L.
Estimation of Soil Water Properties,
W83-02459 2G

BRAVO, H. E.
Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

BREDER, R.
Optimization Studies for Reliable Trace Metal Analysis in Sediments by Atomic Absorption Spectrometric Methods,
W83-02609 5A

BRENKERT, A. L.
Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
W83-02729 2I

BRENNEMAN, L. G.
Modeling Sediment Deposition Behind Corn Residue,
W83-02455 4D

BRIDLE, T. R.
Fate of Heavy Metals and Potential For Clinker Formation During Pilot Scale Incineration of Municipal Sludge,
W83-02789 5E

BRINDLEY, P.
Industrial Effluent Control Experience,
W83-02530 5D

BROOKE, L. T.
Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

BROWN, M. J.
Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

BUCHBINDER, G. G. R.
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

BUCHHOLZ, W. B.
Wastewater System Improvements Help Dallas Meet Future Needs,
W83-02771 5D

BUCKLEY, J. A.
Hemoglobin-Glutathione Relationships in Trout Erythrocytes Treated With Monochloramine,
W83-02660 5C

BUETTNER, J. M.
Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

BURGH, J. A.
Attacking Odors with H202,
W83-02765 5F

BURKE, H-H. K.
Detection of Rainfall Rates Utilizing Spaceborne Microwave Radiometers,
W83-02798 2B

BUSCH, W. H.
Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

BYRNE, P. A.
Salting-Out of Methane in Single-Salt Solutions at 25 Degrees C and Below 800 PSIA,
W83-02583 2K

CABASSO, I.
Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

CADOTTE, J. E.
Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

CALL, D. J.
Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

CALLES, U. M.
Diurnal Variations in Electrical Conductivity of Water in a Small Stream,
W83-02776 2K

CAMPBELL, C. A
Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

CAMPBELL, H. W.
Fate of Heavy Metals and Potential For Clinker Formation During Pilot Scale Incineration of Municipal Sludge,
W83-02789 5E

The Use of Rheology for Sludge Characterization,
W83-02757 5D

CAMPBELL, W.
Treatment of Unusual Inorganic Wastes,
W83-02580 5D

CARBERY, T. R.
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

CARLTON-SMITH, C. H.
Field Performance of RBC'S.
W83-02533 5D

CARTER, D. C.
Industrial Effluent Control Experience,
W83-02530 5D

CASTEL, J. R.
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

CATLIN, T. S.
Rate Structure Alternatives for Utilities,
W83-02473 6C

CHANG, A. T. C.
Measurement and Modeling of Microwave Emission from Forested Snowfields in Michigan,
W83-02774 2C

CHANG, H. H.
Fluvial Hydraulics of Deltas and Alluvial Fans,
W83-02678 8B

Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

CHAUBE, A.
Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

CHEBOTINA, M. YA.
90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

CHERKEZOV, N. V.
Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

CHERNYSHEV, L. V.
Theory of Hydrothermal Equilibria of Minerals of Variable Composition,
W83-02586 2K

CHIAN, E. S. K.
Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

CLARKE, N.
High Purity Water Using H202 and UV Radiation,
W83-02531 5F

CODIN-BLUMER, G.
Effects of Impoundment of Desaulniers Reservoir (James Bay Territory) on Zooplankton in a River and a String Bog. (Effets De La Mise En Eau Du Reservoir Desaulniers (Territoire De La Baie De James) Sur Le Zooplancton D'Une Riviere Et D'Une Tourbiere Reticulee),
W83-02604 6G

COLLINS, T. J.
Inspection and Maintenance of Dam Dewatering Facilities,
W83-02770 8C

COOK, J. A.
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

COOK, R. L.
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

COOLEY, K. R.
Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

COUILLARD, D.
Evaluation of Organochlorine Contents in the Saint Lawrence River, Estuary and Gulf, Canada (Evaluation Des Teneurs En Composes Organochlores Dans Le Fleuve, L'Estuaire Et Le Golfe Saint-Laurent, Canada),
W83-02578 5B

COUPAL, B.
Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

COURT, A.
Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

CRESCUOLO, P. J.
Fate of Heavy Metals and Potential For Clinker Formation During Pilot Scale Incineration of Municipal Sludge,
W83-02789 5E

The Use of Rheology for Sludge Characterization,
W83-02757 5D

CREUTZBERG, F.
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

CUSTER, S. G.
The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

D'ITRI, F. M.
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

DAVIDSON, D. H.
Acclimation to and Biodegradation of Nitrilotriacetate (NTA) at Trace Concentrations in Natural Waters,
W83-02461 5B

DAVIES, A. G.
The Construction of the Tugela-Vaal Project Dams,
W83-02643 8A

DAVIS, J. A.
Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

DE KIMPE, C. R.
Effect of Subterranean Drainage on Some Properties of Clay Soils in Quebec (Effet du Drainage Souterrain Sur Quelques Proprietes de Sols Argileux du Quebec),
W83-02613 2G

DE WITT, M. J.
Concrete Waterway Linings for the Drakensberg Pumped Storage Scheme,
W83-02668 8F

DEBELAK, K. A.
Ozonalysis for Water Reuse Applications,
W83-02498 5F

DEHON, P.
Surface Temperature Model for Evaporation Pans (Modelisation De La Temperature De Surface Des Bacs Evaporometriques),
W83-02673 2D

DELABRE, D. L.
The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

DEMASTER, D. J.
Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

DENIS, J. C.
The Adaptation of Varieties of Sorghum to Different Water Regimes,
W83-02612 2I

DEPINTO, J. V.
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

DERBY, J. C.
Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

DEWALLE, F. B.
Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

DEWILDE, P. A. W. J.
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

DHAR, O. N.
Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

DIBIAGIO, E.
Norwegian Practice in Instrumenting Dams,
W83-02630 8G

DIEZ GONZALEZ, J. J.
Contamination of the Mediterranean Coast and its Control as a Problem of Land Management (La Contaminacion Litoral Mediterranea Y su Correccion Como un Problema De La Ordenacion Territorial),
W83-02777 5B

DILOV, H. V.
Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedes-

DILOV, H. V.

mus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

DITTMER, E.
Halting Creek Pollution,
W83-02768 5B

DOBREVSKY, I.
Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

DOLD, P. L.
Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

DOMENECH, S.
Mathematical Model of a Mechanical Vapour Compression Evaporator. Application to Seawater Desalting. Part I-The Model Settlement,
W83-02526 3A

DONENBERG, V. M.
Estimation of the Size and Roughness of Sediments in Hydraulic Calculations,
W83-02622 8B

DONOVAN, J. J.
Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

DRABLOS, C. J. W.
A Model for Drainage Benefits,
W83-02452 4A

DRACOS, T.
Technology--What is it For. Two Examples from the More Than 2,000-Year History of Hydraulic Engineering in China (Technik Wozu. Zwei Beispiele Aus Der Uber 2000Jahrigen Geschichte Des Wasserbaues in China),
W83-02760 8A

DROVOT, P. I.
Trace Elements in Tissues of Commercial Fish From Lake Ladoga,
W83-02598 5B

DUCKSTEIN, L.
Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

DUNCAN, L. C.
Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

DUPONT, S.
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

EASTWOOD, M. T.
Concrete Waterway Linings for the Drakensberg Pumped Storage Scheme,
W83-02668 8F

ECCHER, L.
Spillway Aeration of the San Roque Project,
W83-02540 8B

EDMUNDS, W. M.
Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

EILERS, R. G.
Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

ELGES, H. F. W. K.
The Dams of the Tugela-Vaal Project,
W83-02648 8A

ELLINGHOUSE, C.
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

ELLIS, J. B.
Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

ENJALBERT, M.
Mathematical Model of a Mechanical Vapour Compression Evaporator. Application to Seawater Desalting. Part I-The Model Settlement,
W83-02526 3A

ERASMUS, J. J.
Environmental Considerations of the Drakensberg Pumped Storage Scheme,
W83-02664 6G

ERB, F.
The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

ERICKSON, R. E.
Pesticides in Lower Flathead Valley Drainage,
W83-02496 5A

ESPOSITO, G. L.
Effluent Limitations Based on Water Quality,
W83-02466 5E

ESSIG, M. G.
Pesticides in Lower Flathead Valley Drainage,
W83-02496 5A

EVANS, R. H.
Field Performance of RBC'S.
W83-02533 5D

EVANS, R. L.
Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

FACY, G.
Drinking Water and Its Pricing (Eau Potable et Tarification),
W83-02652 6C

FAHRNI, H-P.
Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

FAISON, J. H.
Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

FANELLI, M.
Safety Monitoring of Concrete Dams,
W83-02632 8F

FAUP, G. -M.
Biological Nitrification in an Up Flow Fixed Bed Reactor (UFBR),
W83-02747 5D

FEDERLE, T. W.
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

FEIERABEND, R.
Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

FENDER, K.
Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

FENDT, H.
More Confidence in Planning Through Capacity Standards for Water Supply Systems (Mehr Planerische Sicherheit Durch Die Ableitung Von Kapazitatsbemessungsgrund Lagen Fur Die Wasserwirtschaft),
W83-02763 6D

FERERES, E.
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

FFOLLIOTT, P. F.
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

FISHMAN, YU. A.
Current Requirements Imposed on the Contact of Gravity and Buttress Dams with Rock Foundations,
W83-02595 8E

FITZPATRICK, M. D.
Instrumenting Australia's Cethana Dam,
W83-02603 8A

FLETCHER, S. T.
Designing and Installing Large Steel Water Mains to Prevent Failures,
W83-02710 5F

FLORIDIS, F.
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

FOGGIN, G. T.
The Influence of Kokanee Salmon and Man on the Water Quality of Lower McDonald Creek, Glacier National Park, Montana,
W83-02494 5C

FOSTER, J. H.
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

FOSTER, J. L.
Measurement and Modeling of Microwave Emission from Forested Snowfields in Michigan,
W83-02774 2C

FOWLER, A. C.
Waves on Glaciers,
W83-02699 2C

FRANKLIN, B. W.
Maintaining Distribution System Valves and Fire Hydrants,
W83-02714 8C

FREESE, J. W.
Measuring Chlorine Dioxide With a Rotating Voltammetric Membrane Electrode.
W83-02682 5A

FRENETTE, M.
Case History of Sedimentation at Peligre Dam, Haiti (Cas Historique de Sedimentation du Barrage Peligre, Haiti),
W83-02611 2J

GABBERT, W. A.
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

GABEL, B.
Pollution of Drinking Water With Nitrate,
W83-02646 5B

GADBOIS, D. F.
Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

GAIPOVA, A. P.
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

GALL, J. J.
Rate Structure Alternatives for Utilities,
W83-02473 6C

GARCIA GOMEZ, J.
Estimation of the Sewage Loading of the Mediterranean at the Beaches of Valencia, Spain (Estimacion de la Carga Contaminante Vertida al Mar Mediterraneo en el Litoral Proximo a la Ciudad de Valencia (Espana)),
W83-02796 5B

GAUME, A. N.
Attacking Odors with H202,
W83-02765 5F

GAVRISHOVA, N. A.
Distribution of Actinomycetes in Natural Waters (A Survey),
W83-02624 5B

GAY, M. L.
Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

GEPPERT, B.
Economics of Precipitant Use in Municipal Wastewater Treatment Plants (Wirtschaftlichkeit Des Fallmitteleinsatzes in Kommunalen Klaranlagen),
W83-02591 5D

GERARDI, M. H.
Aquatic Invaders,
W83-02766 5F

Superbugs: Bacteria for Wastewater Treatment Plants,
W83-02769 5D

GERSHON, M.
Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

GHUGARE, R. V.
Release of Fe, Mn and P in a Calcareous Vertisol and Yield of Upland Rice as influenced by Presowing Soil Water Treatments,
W83-02797 2I

GIFFORD, G. F.
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

GIGER, W.
Persistent Organic Chemicals in Sewage Effluents. 2. Quantitative Determinations of Nonylphenols and Nonylphenol Ethoxylates by Glass Capillary Gas Chromatography,
W83-02529 5A

GIL'MAN, V. L.
Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

GINSBERG, W. R.
A Public Policy for Hazardous Wastes,
W83-02653 6E

GIUSEPPETTI, G.
Safety Monitoring of Concrete Dams,
W83-02632 8F

GLEISBERG, D.
Economics of Precipitant Use in Municipal Wastewater Treatment Plants (Wirtschaftlichkeit Des Fallmitteleinsatzes in Kommunalen Klaranlagen),
W83-02591 5D

GNAUCK, A.
Improvement of the Accuracy of Prediction of Stochastic Models of the Oxygen Concentration in Running Waters (Verbesrung der Vorhersagegenauigkeit Stochastischer Modelle des Sauerstoffgehaltes von Fliessgewassern),
W83-02658 2E

GOFF, F.
Valles Caldera Geothermal Systems, New Mexico, U.S.A.,
W83-02701 2F

GRABITZ, E.
Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

GRADY, T. R.
The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

GRAF, W. L.
Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

GRAY, S. L.
Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

GREGORI, J.
Developments in Pump-Turbines,
W83-02536 8C

GRIGSBY, C. O.
Valles Caldera Geothermal Systems, New Mexico, U.S.A.,
W83-02701 2F

GRIMES, D. W.
Cotton Growth Related to Plant's Water Status,
W83-02576 3F

GRIMM, J. K.
Aquatic Invaders,
W83-02766 5F

GRISSINGER, E. H.
Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

GRIST, E.
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

GUERIN, B.
Agricultural Use of Sugar Refinery Wastewater Change in Mineral Nitrogen in Soils Used for Landspreading (Valorisation Agricole Des Effluents En Sucrerie, Etude De L' Evolution De L' Azote Mineral Dans Les Sols Soumis Aux Epandages),
W83-02633 3C

GULLEDGE, W. P.
Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

GUNSON, H. G.
Aerobic Thermophilic Digestion of Sewage Sludge,
W83-02568 5E

GUPTA, R. K.
Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

GUPTA, V. K.
Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
W83-02635 5A

GUY, H. P.
Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

GUYMON, G. L.
Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

HAACK, T. K.
The Microbial Dynamics of an Epilithic Algal-Bacterial Mat Community in an Oligotrophic, High Alpine Stream,
W83-02490 5B

HAGENMAIER, H.
Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

HAHN, H. H.
Economics of Precipitant Use in Municipal Wastewater Treatment Plants (Wirtschaftlichkeit Des Fallmitteleinsatzes in Kommunalen Klaranlagen),
W83-02591 5D

HAINES, D.
Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

HALL, D. K.
Measurement and Modeling of Microwave Emission from Forested Snowfields in Michigan,
W83-02774 2C

HALLIER, P. A. C.
Construction of the Main Civil Works of the Drakensberg Pumped Storage Scheme,
W83-02665 8A

HAMILTON, R.
Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

HAMMA, T.
The Seasonal Variation of Organic Constituents in a Eutrophic Lake, Lake Suwa, Japan. Part 1, Particulate Organic Matter,
W83-02559 5C

HAMMOND, K. A.
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

HAMPTON, K.
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

HANDA, N.
The Seasonal Variation of Organic Constituents in a Eutrophic Lake, Lake Suwa, Japan. Part 1, Particulate Organic Matter,
W83-02559 5C

HANITSCH, P. H.
Flushing and Shutoff Devices for Sewers (Spul- und Absperrorgane fur Abwasserkanale),
W83-02619 5D

HARDY, K. R.
Detection of Rainfall Rates Utilizing Spaceborne Microwave Radiometers,
W83-02798 2B

HARFOOT, C. G.
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

HARLAN, C. W.
Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

HARMSEN, J.
Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

HARPER, W. B.
Inspecting, Painting, and Maintaining Steel Water Tanks,
W83-02713 8G

HARRINGTON, D. W.
Field Performance of RBC'S.
W83-02533 5D

HARRIS, D.
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

HARRIS, T. R.
Analysis of Irrigation Pumping and Application Efficiency in Nevada,
W83-02499 3F

HASHIMOTO, Y.
A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

HAYES, S. P.
Toxic Substances Monitoring Program - 1981,
W83-02719 5A

HAYS, L. M.
Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

HEEDE, B. H.
Gully Control: Determining Treatment Priorities for Gullies in a Network,
W83-02544 4D

HEERDEGEN, R. G.
Quantifying Source Areas Through Land Surface Curvature and Shape,
W83-02702 2E

HEFNY, K.
Land-Use and Management Problems in the Nile Delta,
W83-02462 6G

HEGG, R. O.
Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

HEITZ, F.
Agricultural Use of Sugar Refinery Wastewater Change in Mineral Nitrogen in Soils Used for Landspreading (Valorisation Agricole Des Effluents En Sucrerie, Etude De L' Evolution De L' Azote Mineral Dans Les Sols Soumis Aux Epandages),
W83-02633 3C

HEITZ, L. F.
Identification of Snowcover Depletion Patterns Using Satellite Imagery,
W83-02488 2C

HELZ, G. R.
Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

HEMMING, M. L.
Treatment of Unusual Inorganic Wastes,
W83-02580 5D

HENDRY, B. A.
Continuous Countercurrent Ion Exchange for Desalination and Tertiary Treatment of Effluents and Other Brackish Waters,
W83-02792 3A

HENRIKSEN, A.
Acidification of Groundwater in Norway,
W83-02793 2K

HERBERT, R.
The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

HERBERT, R. A.
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

HERRERA, I.
Boundary Methods in Water Resources,
W83-02655 8A

HERRMANN, C. C.
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

HERRNHUT, H.
Wastewater Sludge Disinfection With Gamma-Rays: An Overview (Klarschlammhygienisierung Mit Gamma-Strahlen: Ein Uberblick),
W83-02505 5D

HOLGNE, J.
Decomposition of Ozone in Water: Rate of Initiation by Hydroxide Ions and Hydrogen Peroxide,
W83-02577 5F

HOLL, G. W.
Construction of the Main Civil Works of the Drakensberg Pumped Storage Scheme,
W83-02665 8A

HOLZ, K. -P.
Tidal Wave Analysis for Estuaries with Intertidal Flats,
W83-02637 2L

HOLZAPFEL, E.
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

HOOPER, F. F.
Prediction of Effects of Daily Flow Fluctuations on Stream Biota,
W83-02480 6G

HOOSHIARI, H.
Saltation in Water Dynamics,
W83-02679 8B

HOOVER, M. G.
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

HOPITAULT, J. C.
The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

HOUBA, C.
Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

HOWARD, A. G.
Seasonal Variability of Biological Arsenic Methylation in the Estuary of the River Beaulieu,
W83-02471 5B

HROMADKA, T. V.
Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

HSU, J. C.
Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

HUMASON, A. W.
Determination of Polynuclear Aromatic Hydrocarbons in the New York Bright Area,
W83-02642 5B

HUMPHRIES, W.
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

HUSBAND, F. M.
The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

HUSER, V. C.
The Crest Dispute: A Mediation Success,
W83-02532 6D

HUSTERT, K.
The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

IDELOVITCH, E.
A New Configuration of the High-Lime Process with Sludge Recirculation for Magnesium Recycling,
W83-02751 5D

IKEDA, S.
Lateral Bed Load Transport on Side Slopes,
W83-02709 8B

INCZE, L. S.
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

ISAAC, R. A.
Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

ISRAELACHVILI, J.
The Hydrophobic Interaction Is Long Range, Decaying Exponentially with Distance,
W83-02778 1B

JACKSON, G. A.
Sludge Disposal in Southern California Basins,
W83-02527 5E

JAME, Y. W.
Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

JAYNES, R. A.
A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

JEWELL, W. J.
Engineers Assess Aquaculture Systems For Wastewater Treatment - Part II,
W83-02649 5D

JIKA, N. I.
The Adaptation of Varieties of Sorghum to Different Water Regimes,
W83-02612 2I

JOHNS, G. E.
Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

JOHNSON, A. T.
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

JOHNSON, J. A.
Start-Up and Operation of an Oxygen-Activated Advance Wastewater Treatment System,
W83-02680 5D

JONES, B.
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

JORDAN, P.
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

JULSHAMN, K.
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

KALBE, L.
Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

KAMINSKII, V. S.
Urgent Problems of Conservation and Rational Use of Water Resources,
W83-02623 5G

KAMMERER, P. A.
Sediment Deposition in a Flood-Retention Structure After Two Record Floods in Southwestern Wisconsin,
W83-02705 4D

KANIVETSKY, R.
Ground-Water Recharge Rates in Minnesota as Related to Precipitation,
W83-02730 2F

KAROL, L. A.
Use of Energy Storage by Increasing the Head of the Hydroelectric Station-Pumped Storage Station,
W83-02620 8C

KAUFMAN, D. E.
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

KAWATA, K.
Slow Sand Filtration for Cercarial Control in North Cameroon Village Water Supply,
W83-02790 5F

KECK, G.
PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

KEITH, S. M.
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

KELETI, G.
Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

KEMZHAYEV, M. A.
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

KENNARD, M. F.
Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

KEUNE, H.
Make Applications According to the State Wastewater Tax Laws on Time (Die Antrage Nach Den Landes-Abwasserabgabengesetzen Rechtzeitig Stellen),
W83-02786 6E

KFIR, R.
Detection of Potential Carcinogens and Toxicants in Tap and Reclaimed Water by the Golden Hamster Cell Transformation Assay,
W83-02460 5A

KHOSLA, B. K.
Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

KIDO, S.
Operation of Meff Desalination Plant (Multiple Effect Falling Film Process),
W83-02525 3A

KIM, B. -J.
The Scale-Up and Limitation of Physical Oxygen Transfer in Rotating Biological Contactors,
W83-02750 5D

KING, D. L.
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

KING, R. D.
Lake Fidler, a Meromictic Lake in Tasmania,
W83-02557 2H

KIRKHUSMO, L. A.
Acidification of Groundwater in Norway,
W83-02793 2K

KISHIMA, N.
Oxygen-18 and Deuterium Determination on a Single Water Sample of a Few Milligrams,
W83-02651 1A

KLEIN, G.
Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

KLEIN, W.
Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

KLOPP, P.
Significance of River Flow for the Suspended Solids Burden and its Retention in the Impounded Ruhr (Bedeutung Des Abflusses Fur Die Schwebstofffracht Und Ihre Retention in Der Gestauten Ruhr),
W83-02587 2J

KNEZEK, D. B.
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

KNIGHT, R. W.
Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

KNOWLES, G.
High Purity Water Using H202 and UV Radiation,
W83-02531 5F

KOGAN, SH. I.
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

KOH, R. C. Y.
Initial Sedimentation of Waste Particulates Discharged From Ocean Outfalls,
W83-02565 5B

KOHL, H. H.
Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

KONIGER, W.
Use of the Extremal-3 Distribution in Precipitation Evaluation and Low Water Analysis (Die Anwendung Der Extremal-3-Verteilung Bei Der Regenauswertung Und Der Niedrigwasseranalyse),
W83-02590 2B

KORNATZKI, K. -H.
Significance of River Flow for the Suspended Solids Burden and its Retention in the Impounded Ruhr (Bedeutung Des Abflusses Fur Die Schwebstofffracht Und Ihre Retention in Der Gestauten Ruhr),
W83-02587 2J

KORT, R. L.
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

KORTE, F.
The EPA-Test – A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

KOSHELEVA, S. I.
The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

KOSSLER, E.
Improvement of the Power Output of Hydroelectric Plants (Verbesserung Der Leistungsfahigkeit Von Wasserkraftwerken),
W83-02800 8C

KOTHANDARAMAN, V.
Aeration-Destratification of Lake Eureka Using A Low Energy Destratifier,
W83-02720 5F

KOZHEVNIKOVA, T. E.
Experience in Predicting Elements of the Ice and Thermal Regime of the Lower Pools of Hydroelectric Stations,
W83-02621 2C

KOZICKI, R.
Pollution of Drinking Water With Nitrate,
W83-02646 5B

KPORDZE, C. S. K.
Experience Curves for Feasibility Studies and Planning of Modern Low-Head Hydro Turbines,
W83-02489 8C

KRAMER, J.
Acidification of Aquatic Systems: A Critique of Chemical Approaches,
W83-02567 2K

KRAYNOV, S. R.
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

KRAYNOVA, L. P.
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

KRISTENSEN, G. H.
Effect of Denitrification on the pH in Biofilms,
W83-02752 5D

KRUMGALZ, B. S.
Physico-Chemical Study of Dead Sea Water, II. Density Measurements and Equation of State of Dead Sea Water at 1 ATM,
W83-02464 2H

KUEHL, S. A.
Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

KUHN, R.
Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

KUIPERS, B. R.
Energy Flow in a Tidal Flat Ecosystem,
W83-02475 2L

KUMAR, N. V. N.
Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

KURANZ, J. H.
Valve and Hydrant Maintenance,
W83-02782 5F

KUSHNAREV, D. M.
Parameters of Canals Constructed by the Crater Blasting Method,
W83-02596 8H

KUZNETSOV, E. B.
Multistage Whirlpool Shaft Spillways,
W83-02597 8A

LACARO, F.
Toxic Substances Monitoring Program - 1981,
W83-02719 5A

LAFLEN, J. M.
Modeling Sediment Deposition Behind Corn Residue,
W83-02455 4D

LAHL, U.
Pollution of Drinking Water With Nitrate,
W83-02646 5B

LAI, C.
Flow Computation Using Extrapolation Procedures,
W83-02695 2E

LAMBERT, J. R.
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

LAMBERTI, G. A.
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

LANDRUM, P. F.
Uptake, Depuration and Biotransformation of Anthracene by the Scud Pontoporeia Hoyi,
W83-02549 5B

LANE, L. J.
Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

LARSON, G. J.
Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

LARSON, R. J.
Acclimation to and Biodegradation of Nitrilotriacetate (NTA) at Trace Concentrations in Natural Waters,
W83-02461 5B

LAVERDIERE, M. R.
Effect of Subterranean Drainage on Some Properties of Clay Soils in Quebec (Effet du Drainage Souterrain Sur Quelques Proprietes de Sols Argileux du Quebec),
W83-02613 2G

LAW, I. A.
The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

LAY, J. P.
Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

LAZAREK, S.
Structure and Function of a Cyanophytan Mat Community in an Acidified Lake,
W83-02610 2H

LE MASSON, H.
Seeking Consumers Cooperation in the Financing of Water Supply (Conditions Permettant Aux Consommateurs A Ressources Limitees De Participer Au Financement De Leur Consommation D Eau),
W83-02634 6C

LE ROUX, A-Y.
A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

LEACH, B.
The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

LEGGE, W. C. S.
The Sterkfontein Dam Outlet Works,
W83-02666 8A

LEMBKE, W. D.
A Model for Drainage Benefits,
W83-02452 4A

LEPRINCE, A.
Biological Nitrification in an Up Flow Fixed Bed Reactor (UFBR),
W83-02747 5D

LESTER, J. N.
The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

LETTERMAN, R. D.
Survey of Polyelectrolyte Coagulant Use in the United States,
W83-02691 5F

LEYSHON, A. J.
Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

LIGHT, W. G.
Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

LINDNER, H.
The Hundred-Year Effort to Secure Hong Kong's Water Supply (Hundertjahriges Bemuhen um Hong Kong's Wasserversorgung),
W83-02762 3B

LINSMITH, M. J.
Industrial Effluent Control Experience,
W83-02530 5D

LITTLE, W. C.
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

LIVINGSTON, W. H.
Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

LOEHR, R. C.
Priority Pollutants in Municipal Sewage Sludge,
W83-02552 5E

LOGAN, R. M.
Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

LONG, D. T.
Field Evidence for Shale Membrane Filtration of Groundwater, South-Central Michigan,
W83-02483 2F

LORENZ, R. C.
Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

LOVE, O. T. JR.
Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

LUMSDEN, E. M.
Determination of Radium-228 in Foods and Water,
W83-02686 5A

LYUBEZNOV, YU. YE.
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

MACKO, S. A.
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

MAEDA, M.
Behavior of Uranium in Two Estuaries of the Southeastern United States,
W83-02465 2L

MAGNIN, E.
Effects of Impoundment of Desaulniers Reservoir (James Bay Territory) on Zooplankton in a River and a String Bog. (Effets De La Mise En Eau Du Reservoir Desaulniers (Territoire De La Baie De James) Sur Le Zooplancton D'Une Riviere Et D'Une Tourbiere Reticulee),
W83-02604 6G

MANAHAN, S. E.
Sorption Incineration of Chlorinated Hydrocarbons, Acid, Heavy Metals, and Excess Nutrients in Water Using Coal-Derived Solids,
W83-02484 5F

MANDAL, B. N.
Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

MANGOLD, S.
Thickening and Biological Disinfection of Wastewater Sludge by Submersed Rotation Aeration (Eindickung Und Biologische Entseuchung Von Abwasserschlamm Durch Submerse Umwalzbeluftung),
W83-02506 5D

MANSOUR, M.
The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

MARAIS, G. V. R.
Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

MARAZIO, A.
Monitoring Dams and Their Foundations,
W83-02629 8D

MARCH, P. A.
Flow Measurements at Raccoon Mountain,
W83-02535 8C

MARKEE, T. P.
Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

MARKI, E.
Further Action by the Cantons. Aargau Canton (Das Weitere Vorgehen Der Kantone. Kanton Aargau),
W83-02758 5G

MAROTZ, G. W.
Field Determination of Infiltration Parameters (Bestimmung von Infiltrationsparametern mit Hilfe von Feldmessungen),
W83-02785 2G

MARRA, C.
Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

MARTI GALLEGO, P.
Estimation of the Sewage Loading of the Mediterranean at the Beaches of Valencia, Spain (Estimacion de la Carga Contaminante Vertida al Mar Mediterraneo en el Litoral Proximo a la Ciudad de Valencia (Espana)),
W83-02796 5B

MARTIN, D. C.
Computer Assisted Analysis to Improve Water System Operation,
W83-02799 5F

MARTIN, G.
A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

MARTIN, P. J. H.
Turbidity and its Causes in a Narrow Glacial Lake With Winter Ice Cover,
W83-02470 2H

MARTINICH, D. A.
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

MASON, J. M. JR.
Responsibility for Runoff Control,
W83-02467 6E

MATSUO, T.
Interactions Between Amino-Acid-Degrading Bacteria and Methanogenic Bacteria in Anaerobic Digestion,
W83-02515 5D

MAVROV, V.
Effect of Recovery on Desalination of the Black Sea Water by Reverse Osmosis,
W83-02522 3A

MAYER, L. M.
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

MCANIFF, R.
Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

MCBRIDE, D. G.
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

MCCARTY, W. M.
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

MCCLELLAND, B. R.
The Influence of Kokanee Salmon and Man on the Water Quality of Lower McDonald Creek, Glacier National Park, Montana,
W83-02494 5C

MCCONNEN, R. J.
The Economic Impacts of Alternatives and Contingencies Relating to the 1978 Decisions of the Montana Board of Natural Resources on Water Reservations in the Yellowstone Basin,
W83-02493 6B

MCCOY, G.
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

MCDONALD, D. B.
Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

MCDONNELL, A. J.
Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

MCELRAVY, E. P.
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

MCFETERS, G. A.
The Microbial Dynamics of an Epilithic Algal-Bacterial Mat Community in an Oligotrophic, High Alpine Stream,
W83-02490 5B

MCKINLEY, V. L.
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

MCNICOLL, R.
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

MELLORS, T. W.
Rock Engineering Investigation and Design Studies for the Drakensberg Pumped Storage Scheme,
W83-02644 8E

MENSINGH, G. F.
The Occurrence of PCH3-Containing Compounds in Surface Waters,
W83-02518 5A

METCALF, R. R.
Effective Start-Up Training for Wastewater Treatment Plants,
W83-02772 5D

MEZ, F.
Unique Design for Guijo De Granadilla,
W83-02538 8C

MILES, D. L.
Hydrochemical Evolution of the East Midlands Triassic Sandstone Aquifer, England,
W83-02616 2K

MILLER, L. W.
Automatic Tensiometer Scanner for Rapid Measurements,
W83-02458 7B

MILLER, M. R.
Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

MILLER, W. L.
The Economic Efficiency of Flood Plain Development,
W83-02477 6F

MILLERO, F. J.
Physico-Chemical Study of Dead Sea Water, II. Density Measurements and Equation of State of Dead Sea Water at 1 ATM,
W83-02464 2H

MINDLER, A. B.
Sidestream Treatment of High Silica Cooling Water and Reverse Osmosis Desalination in Geothermal Power Generation,
W83-02486 3A

MOLOF, A. H.
The Scale-Up and Limitation of Physical Oxygen Transfer in Rotating Biological Contactors,
W83-02750 5D

MONOD, G.
PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

MONTAGNE, J.
The Effects of Snow Compaction on Water Release and Sediment Yield-Bridger Bowl Ski Area, Gallatin County, Montana,
W83-02491 2C

MOORE, G. T.
Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

MORA, E. C.
Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

MORAN, D.
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

MORGAN, S. F.
Aerobic Thermophilic Digestion of Sewage Sludge,
W83-02568 5E

MORRIS, J. C.
Control of Haloform Production During Chlorination of Naturally Occuring Compounds Through Pre-Ozonation,
W83-02727 5F

MOTLIK, J.
Czechoslovakia's Largest Pumped-Storage Plant,
W83-02542 8A

MOTTS, W. S.
Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

MUHLENHARDT-SIEGEL, U.
Biomass of Marine Macrofauna Communities in a Dumping Area of Sewage Sludge Near the Elbe Estuary (Die Biomasse Mariner Makrobenthos-Gesellschaften im Bemundung),
W83-02627 5C

MURPHEY, J. B.
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

MURPHY, P. J.
Saltation in Water Dynamics,
W83-02679 8B

MURTAGH, R. W.
Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

NADEBAUM, P. R.
Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

NADTOCHIY, B. P.
Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

NAGASE, M.
Interactions Between Amino-Acid-Degrading Bacteria and Methanogenic Bacteria in Anaerobic Digestion,
W83-02515 5D

NAKANO, Y.
Use of Similarity Solutions for the Problem of A Wetting Front - A Question of Unique Representation,
W83-02638 2G

NAYLOR, L. M.
Priority Pollutants in Municipal Sewage Sludge,
W83-02552 5E

NAZARENKO, S. N.
Experience in Predicting Elements of the Ice and Thermal Regime of the Lower Pools of Hydroelectric Stations,
W83-02621 2C

NEIS, U.
Economics of Precipitant Use in Municipal Wastewater Treatment Plants (Wirtschaftlichkeit Des Fallmitteleinsatzes in Kommunalen Klaranlagen),
W83-02591 5D

NESTEROVA, D. A.
Large-Scale Development of Cerataulina Bergonii Perag in the Northwestern Part of the Black Sea,
W83-02602 5C

NEWMAN, J. E.
Weekly Water Use Estimates by Crops and Natural Vegetation in Indiana,
W83-02739 2D

NICHOLAICHUK, W.
Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

NICHOLLS, H. A.
Application of the Marais - Ekama Activated Sludge Model to Large Plants,
W83-02791 5E

NILSEN, K. Y.
Norwegian Practice in Instrumenting Dams,
W83-02630 8G

NINANE, J.
Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

NISHIDOME, K.
Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

NITSCHE, G.
Tidal Wave Analysis for Estuaries with Intertidal Flats,
W83-02637 2L

NITTROUER, C. A.
Modern Sediment Accumulation and Strata Formation on the Amazon Continental Shelf,
W83-02463 2L

NORVELL, W. A.
Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

NOWAK, T. J.
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

NUTTALL, D.
The Populations, Characterization and Activity of Suspended Bacteria in the Welsh River Dee,
W83-02707 5B

NZAKIMUENA, T. J.
Case History of Sedimentation at Peligre Dam, Haiti (Cas Historique de Sedimentation du Barrage Peligre, Haiti),
W83-02611 2J

O'BRIEN, K.
Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

O'DAY, D. K.
Organizing and Analyzing Leak and Break Data for Making Main Replacement Decisions,
W83-02712 5F

O'LEARY, J. T.
Recreation in the Perceived Community Function Perspective,
W83-02740 6B

OCEVSKI, B. T.
Comparative Seasonal Uptake of Glucose and Acetate by Epiphytic Bacteria on the Surfaces of Three Species of Macrophyte in the Littoral Zone of Lake Ohrid, Yugoslavia,
W83-02556 2H

ODGAARD, A. J.
Bed Characteristics in Alluvial Channel Bends,
W83-02698 2J

OKSIYUK, O. P.
The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

OLEYNIK, G. N.
The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

OMURA, T.
Mass-Transfer Characteristics Within Microbial Systems,
W83-02749 5D

ONUMA, M.
Mass-Transfer Characteristics Within Microbial Systems,
W83-02749 5D

OSTERKAMP, W. R.
Relationships Between Morphology of Small Streams and Sediment Yield,
W83-02697 2J

OSTERWALDER, J.
Project Studies and Research Work Concerning Butterfly Valves as Used in Water Power Stations and Retarding Basins (Planungskriterien Und Forschung Bei Drosselklappen Fur Kraftwerksanlagen Und Ruckhaltebecken),
W83-02761 8C

OTSON, R.
Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

OTTEY, D. R.
Prediction of Effects of Daily Flow Fluctuations on Stream Biota,
W83-02480 6G

OZAKI, K.
A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

PADMANABHAN, G.
Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

PALEN, B.
Ground-Water Recharge Rates in Minnesota as Related to Precipitation,
W83-02730 2F

PANNIER, M.
Biological Nitrification in an Up Flow Fixed Bed Reactor (UFBR),
W83-02747 5D

PARK, W. M.
The Economic Efficiency of Flood Plain Development,
W83-02477 6F

PARLAR, H.
The EPA-Test -- A Method for the Determination of Photochemical Degradation of Organic Compounds in Aquatic Systems (Der EPA-Test--Eine Methode Zur Bestimmung Des Photochemischen Abbaus Von Organischen Verbindungen in Aquatischen sytemen),
W83-02519 5A

PASHLEY, R.
The Hydrophobic Interaction Is Long Range, Decaying Exponentially with Distance,
W83-02778 1B

PASSINO, R.
Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

PAZ DOEL, R. M.
Contamination of the Mediterranean Coast and its Control as a Problem of Land Management (La Contaminacion Litoral Mediterranea Y su Correccion Como un Problema De La Ordenacion Territorial),
W83-02777 5B

PENMAN, A. D. M.
Long-Term Monitoring of Embankment Dams in Britain,
W83-02628 8D

PERDELWITZ, D.
The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

PERERA, Y. A. P.
Conventional, Upflow, and Radial Filters: Comparison and Mathematical Modelling,
W83-02615 5F

PERRY, R.
The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

PETERSEN, R. J.
Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

PETERSON, W. C.
Muskingum-Like Approximations for Water Routing,
W83-02696 2E

PFEIFFER, E. H.
Anodic Oxidation for Drinking Water Disinfection, Part II: Studies on Haloform Formation (Anodische Oxidation Zur Trinkwasserdesinfektion, II. Mitteilung: Untersuchungen Zur Haloformbildung),
W83-02589 5F

PHILIPPO, A.
The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

PIKE, E. B.
Field Performance of RBC'S.
W83-02533 5D

PINEL-ALLOUL, B.
Effects of Impoundment of Desaulniers Reservoir (James Bay Territory) on Zooplankton in a River and a String Bog. (Effets De La Mise En Eau Du Reservoir Desaulniers (Territoire De La Baie De James) Sur Le Zooplancton D'Une Riviere Et D'Une Tourbiere Reticulee),
W83-02604 6G

PODBIELSKI, A.
Pollution of Drinking Water With Nitrate,
W83-02646 5B

POLIKARPOV, G. G.
Ecological Foundations of Measures to Protect the Hydrosphere Against Man-Made Pollution,
W83-02626 6G

PONCE, V. M.
Celerity of Transient Bed Profiles,
W83-02694 2J

POPEL, F.
Thickening and Biological Disinfection of Wastewater Sludge by Submersed Rotation Aeration (Eindickung Und Biologische Entseuchung Von Abwasserschlamm Durch Submerse Umwalzbeluftung),
W83-02506 5D

POSTEL, S.
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
W83-02743 6B

PRENDIVILLE, P. W.
Design of the Los Angeles Aqueduct Water Filtration Plant,
W83-02468 5F

PRIMROSE, S. B.
The Isolation of Bacteriophages from the Environment,
W83-02708 5A

PROKOPOVICH, N. P.
Rock Balls at Folsom Dam, California,
W83-02661 8F

PROZESKY, O. W.
Detection of Potential Carcinogens and Toxicants in Tap and Reclaimed Water by the Golden Hamster Cell Transformation Assay,
W83-02460 5A

PYZIKOWSKI, W. Z.
The Design of Drakensberg,
W83-02541 8A

The Drakensberg Pumped Storage Scheme Description of Scheme and Principal Data,
W83-02671 8A

QUISENBERRY, V. L.
Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

RAGAB-DEPRE, N. J.
Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

RAJARATNAM, N.
Surges of Finite Height,
W83-02631 8B

RAJENDRABABU, S.
Simple Paper Chromatographic Method for Rapid Detection of Chromate (VI) in Fresh Water,
W83-02687 5A

RAKHECHA, P. R.
Storing Monsoon Rainfall in Indian Reservoirs,
W83-02571 3B

RALSTON, D. R.
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

RANDEGGER, E.
Unique Design for Guijo De Granadilla,
W83-02538 8C

RAO, A. R.
Order Selection of AR Models of Hydrologic Time Series,
W83-02476 2A

RASMUSSEN, W. O.
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

RATHBUN, R. E.
Fate of Acetone in Water,
W83-02645 5B

RAWLS, W. J.
Estimation of Soil Water Properties,
W83-02459 2G

REED, R. H.
Characterization of Fouling Potential for Pressure-Driven Membrane Processes: A New Simulated Flow Cell,
W83-02745 3A

REED, S. C.
Engineers Assess Aquaculture Systems For Wastewater Treatment - Part II,
W83-02649 5D

REEVE, D. W.
The Effect of Chlorine Dioxide Substitution in the First Stage of Pulp Bleaching on Bleach Plant Effluent BOD,
W83-02469 5D

REHWOLDT, R.
Water Chemicals Codex,
W83-02546 5F

REID, R. O.
Numerical Convolution for Solution of Wave Propagation Problems: Filter Scheme Methods,
W83-02672 8B

REID, W.
Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

REINER, C.
Toxic Substances Monitoring Program - 1981,
W83-02719 5A

REINKES, J.
Organic Chemical Fire in Illinois: Emergency Response and Cleanup,
W83-02516 5G

REMACLE, J.
Cadmium Fate in Bacterial Microcosms,
W83-02764 5C

REPKO, J. M.
Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

RESH, V. H.
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

RHOMBERG, E. J.
Responsibility for Runoff Control,
W83-02467 6E

RICE, R. G.
Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

RICHARDS, R. T.
Cooling Systems: Can Engineers Save the Fish,
W83-02551 8I

RIDINGER, D. N.
Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

RINDER, G.
Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

RINGDAL, O.
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

RINGSTAD, O.
Polychlorinated Biphenyls in the Sediments of the Inner Oslofjord,
W83-02783 5B

ROACH, P. A.
Wastewater System Improvements Help Dallas Meet Future Needs,
W83-02771 5D

ROBERTS, A. H.
Sedimentary Characteristics of Suspensions in London Stormwater,
W83-02451 5A

ROBERTS, C. P. R.
Environmental Considerations of the Drakensberg Pumped Storage Scheme,
W83-02664 6G

ROHAN, K.
Modeling of Watercourse CLosure (Modelisation de Fermeture des Cours D'Eau),
W83-02614 8B

ROSSIN, A. C.
The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

ROTH, J. A.
Ozonalysis for Water Reuse Applications,
W83-02498 5F

ROULET, N. T.
Areal Differentiation of Land and Lake Snowcover in a Small Sub-Arctic Drainage Basin,
W83-02775 2C

ROWLEY, A. G.
The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

ROZZI, A.
Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

RUAS, P. M.
Unique Design for Guijo De Granadilla,
W83-02538 8C

RUBIN, H.
Application of the Aquifer's Average Characteristics for Determining the Onset of Thermohaline Convection in a Heterogeneous Aquifer,
W83-02674 2F

Thermohaline Convection in a Nonhomogeneous Aquifer,
W83-02675 2F

RUHLAND, J.
More Confidence in Planning Through Capacity Standards for Water Supply Systems (Mehr Planerische Sicherheit Durch Die Ableitung Von Kapazitatsbemessungsgrund Lagen Fur Die Wasserwirtschaft),
W83-02763 6D

RYZHENKO, B. N.
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

SADYKOV, KH. S.
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

SAKAI, H.
Oxygen-18 and Deuterium Determination on a Single Water Sample of a Few Milligrams,
W83-02651 1A

SAVENKO, V. S.
Acid-Base Equilibrium During Photosynthesis in Water,
W83-02600 2K

SAXTON, K. E.
Estimation of Soil Water Properties,
W83-02459 2G

SBIESCHNI, G.
The Potentiometric Titration of Sulfide in Wastewater Using A Sensitive Electrode (Die Potentiometrische Titration Von Sulfid in Abwasser Mit Hilfe Einer Sensitiven Elektrode),
W83-02639 5A

SCARBOROUGH, J. N.
A Model for Drainage Benefits,
W83-02452 4A

SCHAUERTE, W.
Long-Term Fate of Organochlorine Xenobiotics in Aquatic Ecosystems. Distribution, Residual Behavior, and Metabolism of Hexachlorobenzene, Pentachloronitrobenzene, and 4-Chloroaniline in Small Experimental Ponds,
W83-02608 5B

SCHEFFLER, M. L.
Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

SCHELL, D. M.
Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

SCHLOSSER, A. D.
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

SCHMIDT, K.
Disturbance of Water Purification Process by Algae, Especially During the Infiltration of a Biologically Active Surface Water (Beeintrachtigung Der Wasserreinigung, Insbesondere Bei Der Infiltration Eines Biologisch Hochaktiven Oberflachenwassers),
W83-02717 5G

SCHOERNER, W. S.
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

SCHULHOF, P.
A Mathematical Model of Biological Purification in Aerated Activated Carbon Biofilters,
W83-02755 5D

SCHUSTER, J. L.
Saltcedar Influence on Sedimentation in the Brazos River,
W83-02704 2J

SCHWARTZ, M.
Evaluation of Biological Activated Carbon Industrial Water Reuse,
W83-02742 5D

SCHWEIGER, F.
Developments in Pump-Turbines,
W83-02536 8C

SCHWERI, R.
A Process for the Biological Disinfection of Sludge (Ein Verfahren Zur Biologischen Hygienisierung Von Klarschlamm),
W83-02507 5D

SEELEY, N. D.
The Isolation of Bacteriophages from the Environment,
W83-02708 5A

SEGER, E. S.
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

SERODES, J. B.
Effect of Soil and Coniferous Trees on Some Chemical Characteristics of the Water of Reservoir LG2 (Influence Des Sols Et Arbres Noyes Sur Quelques Caracteristiques Chimiques De L'Eau Du Reservoir LG2),
W83-02520 5B

SEWALL, K.
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

SHAPIRO, M. A.
Mutagenicity of SRC-II Coal Liquefaction Wastewater Treatment Residues,
W83-02564 5D

SHARP, J. C.
Rock Engineering Investigation and Design Studies for the Drakensberg Pumped Storage Scheme,
W83-02644 8E

SHERR, E. B.
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

SHMUL'SON, B. D.
Overflow Road Crossing Across the Dnestr River at the Construction Site of the Dnestr Hydrostation,
W83-02594 8A

SHULTZ, D. J.
Fate of Acetone in Water,
W83-02645 5B

SHVAROV, YU. V.
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

SIEGENTHALER, A.
Spillway Aeration of the San Roque Project,
W83-02540 8B

SINEX, S. A.
Entrapment of Zinc and Other Trace Elements in a Rapidly Flushed Industrialized Harbor,
W83-02545 5B

SINKOVIC, J.
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

SIROUGNET, J. DER.
Unique Design for Guijo De Granadilla,
W83-02538 8C

SLISSKII, S. M.
Multistage Whirlpool Shaft Spillways,
W83-02597 8A

SMART, R. B.
Measuring Chlorine Dioxide With a Rotating Voltammetric Membrane Electrode.
W83-02682 5A

SOBOLL, U.
Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

SOKOLOV, YU. N.
Deposition of Sediments on Thicket-Covered Flood Plain,
W83-02605 2J

SOLIMAN, M. O.
Analysis of a Finite Element Algorithm for Numerical Predictions in Water Resources Research,
W83-02656 8B

SOLOMON, E.
Seismic Safety Analysis of Lower Crystal Springs Dam: A Case History,
W83-02663 8E

SONAR, K. R.
Release of Fe, Mn and P in a Calcareous Vertisol and Yield of Upland Rice as influenced by Presowing Soil Water Treatments,
W83-02797 2I

SONDEREGGER, J. L.
Investigations of Soluble Salt Loads, Controlling Mineralogy, and Factors Affecting the Rates and Amounts of Leached Salts,
W83-02497 2K

SOOS, I. G. K.
Building A Hydro Station in a Narrow Gorge,
W83-02543 8A

SORENSEN, E. M. B.
Selenium Accumulation and Cytotoxicity in Teleosts Following Chronic Environmental Exposure,
W83-02659 5C

SPENCER, C. N.
Maximizing Aquacultural Potential in Municipal Wastewater Ponds,
W83-02485 3C

Quantification of Mechanisms Responsible for Bluegreen Algal Dominance,
W83-02482 2H

SPENDLOVE, R. S.
Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

SPILLER, G.
Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

SPLINTER, R. C.
Long-Term Trends in Nitrate Concentration in Iowa Water Supplies,
W83-02711 5B

ST, C. A.
The Adaptation of Varieties of Sorghum to Different Water Regimes,
W83-02612 2I

STACHEL, B.
Pollution of Drinking Water With Nitrate,
W83-02646 5B

STADELMANN, P.
The Rotsee - An Example of a Lake in Which Water Pollution Control Measures Were Successful (Der Rotsee - Ein Beispiel fur Einen See, Bei Dem Die Gewasserschutzmassnahmen Erfolge Brachten),
W83-02504 5G

STAEHELIN, J.
Decomposition of Ozone in Water: Rate of Initiation by Hydroxide Ions and Hydrogen Peroxide,
W83-02577 5F

STEPHANOU, E.
Persistent Organic Chemicals in Sewage Effluents. 2. Quantitative Determinations of Nonylphenols and Nonylphenol Ethoxylates by Glass Capillary Gas Chromatography,
W83-02529 5A

STEPHENS, D. W.
Fate of Acetone in Water,
W83-02645 5B

STEWART, K. M.
Turbidity and its Causes in a Narrow Glacial Lake With Winter Ice Cover,
W83-02470 2H

STINSON, K. B.
Keeping Clean Water Clean,
W83-02780 5F

STOESSELL, R. K.
Salting-Out of Methane in Single-Salt Solutions at 25 Degrees C and Below 800 PSIA,
W83-02583 2K

STONES, T.
Practical Determination of the First Stage BOD of Sewage,
W83-02581 5A

STOTZKY, G.
Nickel Toxicity to Fungi: Influence of Environmental Factors,
W83-02582 5C

STRACHAN, W. M. J.
A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

STRASSBURGER, A. G.
Hydro-Fracturing at Helms,
W83-02539 8A

STRELTSOVA, T. D.
Well Hydraulics in Vertically Heterogeneous Formations,
W83-02693 2F

SUBBA-RAO, R. V.
Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

SULIMOVA, L. I.
Experience in Predicting Elements of the Ice and Thermal Regime of the Lower Pools of Hydroelectric Stations,
W83-02621 2C

SULLIVAN, J. P. JR.
Maintaining Aging Systems - Boston's Approach,
W83-02689 5F

SWINTON, E. A.
Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

SYKES, A. W.
The Sterkfontein Dam Outlet Works,
W83-02666 8A

SYVERUD, A. N.
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

TAI, D. Y.
Fate of Acetone in Water,
W83-02645 5B

TAYLOR, C. H.
The Effect on Storm Runoff Response of Seasonal Variations in Contributing Zones in Small Watersheds,
W83-02779 2A

TAYLOR, J. J.
Parameters of Deteriorating Microbiological Quality of Selected Surface Waters in Residential Missoula, Montana,
W83-02492 5B

TERBLANCHE, N. J.
Aspects of the Machine Foundation Design at Drakensberg,
W83-02667 8C

TESSIER, A.
Acidification of Aquatic Systems: A Critique of Chemical Approaches,
W83-02567 2K

THERIEN, N.
Simulation of Decomposition of Plant Material and Flooded Soils in the Reservoirs of the James Bay Region (Simulation de la Decomposition de la Matiere Vegetable et des Sols Inondes Dans les Reservoirs de la Region de la Baie de James),
W83-02669 5B

THOMAS, P.
The Fate of Some Metal Species: Lead, Cadmium, Zinc in Surface Water, During Biological Sand Filtration - Effect of Preozonation,
W83-02756 5D

THORNE, C. R.
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

TIMCHENKO, V. M.
Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

TIRAVANTI, G.
Performance Evaluation and Process Design of an Electodialysis Plant by Overpotential Measurements,
W83-02523 3A

TOKURA, K.
A Comparison of Water Solubilities by the Flask and Micro-Column Methods,
W83-02670 5A

TOUHEY, R. J.
Effluent Limitations Based on Water Quality,
W83-02466 5E

TOURNIER, J. P.
Case History of Sedimentation at Peligre Dam, Haiti (Cas Historique de Sedimentation du Barrage Peligre, Haiti),
W83-02611 2J

TRIPP, N. K.
Detection of Rainfall Rates Utilizing Spaceborne Microwave Radiometers,
W83-02798 2B

TUCK, E. O.
Thin Slender Water Jets,
W83-02677 8B

TUMPLING, W.
Investigations on Seasonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

TUOVINEN, O. H.
Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

TURNER, J. V.
Kinetic Fractionation of Carbon-13 During Calcium Carbonate Precipitation,
W83-02570 2K

TYLER, P. A.
Lake Fidler, a Meromictic Lake in Tasmania,
W83-02557 2H

UNRAU, G. O.
Value of Individual Household Water Supplies in the Maintenance Phase of a Schistosomiasis Control Programme in Saint Lucia, After Chemotherapy,
W83-02561 5G

URUSOV, V. S.
Energy Aspects of Equilibrium Cocrystallization From Aqueous Solution,
W83-02585 2K

VALOCCHI, A. J.
Transport of Ion-Exchanging Solutes During Groundwater Recharge,
W83-02478 5B

VAN DEN TOORN, A.
Determination of EDTA in Water by High-Performance Liquid Chromatography,
W83-02676 5A

VAN GRIEKEN, R.
Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

VAN HAANDEL, A. C.
Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

VAN HOOF, F.
Formation and Removal of Mutagenic Activity in Drinking Water by Ozonisation,
W83-02510 5F

VAN ROBBROECK, T. P. C.
The Drakensberg Project: Water and Power for South Africa,
W83-02647 6D

VAN VOAST, W. A.
Symposium on Surface Coal Mining and Reclamation in the Northern Great Plains, an Update on Mine Spoils Hydrology Southeastern Montana,
W83-02495 2F

VASIL'KOVA, L. V.
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

VEKSLER, A. B.
Estimation of the Size and Roughness of Sediments in Hydraulic Calculations,
W83-02622 8B

VENDROV, S. L.
Interaction of Large Hydraulic Engineering Systems with the Environment,
W83-02606 6G

VERHOFF, F. H.
Muskingum-Like Approximations for Water Routing,
W83-02696 2E

VERMEULEN, T.
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

VERWEIJ, A.
The Occurrence of PCH3-Containing Compounds in Surface Waters,
W83-02518 5A

VESTAL, J. R.
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

VIGNESWARAN, S.
Conventional, Upflow, and Radial Filters: Comparison and Mathematical Modelling,
W83-02615 5F

VISCHER, D.
Hydroelectric Power Utilization and Environmental Protection (Wasserkraftnutzung Und Umweltschutz),
W83-02788 6G

VITOSH, M. L.
Impact Evaluation of Increased Water Use by Agriculture in Michigan,
W83-02479 6D

VREUGDENHIL, C. B.
Computation of Flow Patterns in Rivers,
W83-02692 2E

WACHS, A. M.
A New Configuration of the High-Lime Process with Sludge Recirculation for Magnesium Recycling,
W83-02751 5D

WAGNER, G.
Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

WALEN, S.
Feasibility of Increasing Water Supplies and Preventing Environmental Damage by Artificial Recharge in Massachusetts,
W83-02728 3B

WANGNICK, K.
Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

WARNICK, C. C.
Experience Curves for Feasibility Studies and Planning of Modern Low-Head Hydro Turbines,
W83-02489 8C

WARREN, G. H.
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

WARWICK, J. J.
Fate of Nitrogen in Shallow Streams: Focus on Nitrification,
W83-02723 5B

WATANABE, Y.
Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

WATKINS, D.
Toxic Substances Monitoring Program - 1981,
W83-02719 5A

WEEHUIZEN, P. B.
Construction of the Main Civil Works of the Drakensberg Pumped Storage Scheme,
W83-02665 8A

WHEATLEY, W. B.
Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

WIJBENGA, J. H. A.
Computation of Flow Patterns in Rivers,
W83-02692 2E

WILLARDSON, L. S.
Drainage Coefficients,
W83-02454 4A

WILLETT, G. A.
Remote Sensing Determination of Hydrograph Recession Characteristics,
W83-02487 2A

WILLIAMS, D. T.
Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

WILLIS, C. E.
Valuation of Intangibles: The Case of Water Quality,
W83-02732 6B

WINDOM, H. L.
Behavior of Uranium in Two Estuaries of the Southeastern United States,
W83-02465 2L

WINKLER, W.
Improvement of the Accuracy of Prediction of Stochastic Models of the Oxygen Concentration in Running Waters (Verbessrung der Vorhersagegenauigkeit Stochastischer Modelle des Sauerstoffgehaltes von Fliessgewassern),
W83-02658 2E

WOOD, J. R.
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

WOODCOCK, C.
Much More to Rates Than Tradition,
W83-02781 6C

WORLEY, S. D.
Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

YAMADA, H.
Cotton Growth Related to Plant's Water Status,
W83-02576 3F

YANG, P.
Technical Note: Removing Trihalomethane Formation Potential by Coagulation With Activated Silica and Cationic Polymer,
W83-02681 5F

YAPIJAKIS, C.
Direct Filtration: Polymer in Backwash Serves Dual Purpose,
W83-02683 5D

YASHKUL, D. M.
Embankment Dams of Paz Cascade of Hydropower Stations and Some Conclusions From Their Operational Experience,
W83-02593 8E

YOUNG, R. A.
Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

YOUNG, T. C.
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

ZAKI, M. H.
Pesticides in Groundwater: The Aldicarb Story in Suffolk County, NY,
W83-02560 5F

ZHUKINSKIY, V. N.
The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

ZIEMANN, H.
Investigations on Seasonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

ZIEMANN, P.
Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

ZIMNY, B. L.
Novel Polymers in Asymmetric and Composite Reverse Osmosis Membranes,
W83-02502 3A

ORGANIZATIONAL INDEX

ADELAIDE UNIV. (AUSTRALIA). DEPT. OF APPLIED MATHEMATICS.
Thin Slender Water Jets,
W83-02677 8B

AGRICULTURAL RESEARCH ORGANIZATION, BET-DAGAN (ISRAEL). INST. OF SOILS AND WATER.
Rhizos: A Simulation of Root Growth and Soil Processes. Sensitivity Analysis and Validation for Cotton,
W83-02456 2G

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. HYDROLOGY LAB.
Estimation of Soil Water Properties,
W83-02459 2G

AGRICULTURAL RESEARCH SERVICE, BOISE, ID. NORTHWEST WATERSHED RESEARCH CENTER.
Modified Runoff Curve Numbers for Sugarcane and Pineapple Fields in Hawaii,
W83-02706 2A

AGRICULTURAL RESEARCH SERVICE, OXFORD, MS. SEDIMENTATION LAB.
Mass Bank Failure Analysis of Selected Yazoo Basin Streams,
W83-02453 4D

AKADEMIYA NAUK SSSR, IRKUTSK. INST. GEOKHIMII.
Theory of Hydrothermal Equilibria of Minerals of Variable Composition,
W83-02586 2K

AKADEMIYA NAUK SSSR, MOSCOW. INST. GEOKHIMII I ANALITICHESKOI KHIMII.
Energy Aspects of Equilibrium Cocrystallization From Aqueous Solution,
W83-02585 2K

AKADEMIYA NAUK SSSR, SVERDLOVSK. INST. OF PLANT AND ANIMAL ECOLOGY.
90SR and 137CS in Bottom Sediments of a Freshwater Lake,
W83-02599 5B

AKADEMIYA NAUK TURKMENSKOI SSR, ASHKHABAD. INST. BOTANIKI.
Hydrobiological Conditions in the Karakumy Canal,
W83-02625 4A

AKADEMIYA NAUK URSR, KIEV. INST. HIDROBIOLOGII.
The Ecological Classification of the Quality of Surface Waters on Land, Principles and Practical Experience,
W83-02569 5C

Water Exchange Between Sea and Open Estuaries of the Northwestern Coast of the Black Sea,
W83-02601 2L

Distribution of Actinomycetes in Natural Waters (A Survey),
W83-02624 5B

ALASKA UNIV., FAIRBANKS. INST. OF WATER RESOURCES.
Trophic Energetics in Acrtic Freshwater Ecosystems,
W83-02735 2L

ALBERTA UNIV., EDMONTON.
Surges of Finite Height,
W83-02631 8B

ALEXANDRIA UNIV. (EGYPT). DEPT. OF SOIL AND WATER SERVICES.
Water Disinfection With the Hydrogen Peroxide-Ascorbic Acid-Copper(II) System,
W83-02511 5D

ANNE ARUNDEL COUNTY DEPT. OF PUBLIC WORKS, GLEN BURNIE, MD. UTILITY BUREAU.
A Microprocessor Based Water Level Recorder and Sampler Controller,
W83-02457 7B

ANTWERP UNIV., WILRIJK (BELGIUM). DEPT. OF CHEMISTRY.
Preconcentration Methods for the Analysis of Water by X-Ray Spectrometric Techniques,
W83-02654 5A

ANTWERPSE WATERWERKEN (BELGIUM).
Formation and Removal of Mutagenic Activity in Drinking Water by Ozonisation,
W83-02510 5F

ARIZONA UNIV., TUCSON. DEPT. OF SYSTEMS AND INDUSTRIAL ENGINEERING.
Model Selection in Multiobjective Decision Making for River Basin Planning
W83-02650 6A

ARIZONA UNIV., TUCSON. SCHOOL OF RENEWABLE NATURAL RESOURCES.
SEDCON: A Model of Nutrient and Heavy Metal Losses in Suspended Sediment,
W83-02734 2J

ARIZONA WATER RESOURCES RESEARCH CENTER, TUCSON.
A New Configuration of the High-Lime Process with Sludge Recirculation for Magnesium Recycling,
W83-02751 5D

ASIAN INST. OF TECH., BANGKOK (THAILAND). DIV. OF ENVIRONMENTAL ENGINEERING.
Simulation of Nitrification and its Dynamics in a Rotating Biological Contactor,
W83-02754 5D

AUBURN UNIV., AL. DEPT. OF POULTRY SCIENCE.
Properties of New Chloramine Disinfectant and Detoxicant,
W83-02733 5E

AUSTRALIAN NATIONAL UNIV., CANBERRA. DEPT. OF APPLIED MATHEMATICS.
The Hydrophobic Interaction Is Long Range, Decaying Exponentially with Distance,
W83-02778 1B

BADEN-WUERTTEMBERG LANDESANSTALT FUER UMWELTSCHUTZ (GERMANY, F.R.). INST. OF SEENFORSCHUNGS FISCHEREIWESEN.
Evaluation of the Results of Drinking Water Studies According to Appendix 1 to Paragraph 3 of the Drinking Water Ordinance (Auswertung der Ergebnisse Von Trinkwasseruntersuchungen Gemass Anlage 1 zu Paragraph 3 der Trinkwasserverordnung),
W83-02618 5F

BOGERT (CLINTON) ASSOCIATES, FORT LEE, NJ.
Obtaining Secondary Treatment with RBC/Underflow Clarifiers,
W83-02753 5D

BREMER UMWELTINSTITUT FUER DIE ANALYSE UND BEWERTUNG VON SCHADSTOFFEN (GERMANY, F.R.).
Pollution of Drinking Water With Nitrate,
W83-02646 5B

BUCKAU-WALTHER A.G., ESSEN (GERMANY, F.R.). WATER ENGINEERING DIV.
Ship-Mounted Seawater 2500 Cu M/D Flash Evaporation Plant for Adu Dhabi. Economical Drinking Water for Arid Regions,
W83-02524 3A

BULGARIAN ACADEMY OF SCIENCES, SOFIA. NAUCHNO-PROIZVODSTVENA LAB. PO ALGOLOGIYA.
Dynamics of Phosphorus and Nitrate Removal from Partially Purified Waste Waters of Pig Breeding Farms by Means of Isolate Cultivations from the Genera Chlorella and Scenedesmus (Dinamika na Otstranyavane na Fosfor I Nitrati ot Chastichno Biologichno Prechistena Otpaduchna Voda ot Svinekompleks pri Kultivirane Na Izolati ot Rodovete Chlorella I Scenedesmus),
W83-02773 5D

BUNDESAMT FUER UMWELTSCHUTZ, BERN (SWITZERLAND). ABT. NATURWISSENSCHAFTEN UND FISCHEREI.
Heavy Metals in Wastewater--Origins and Significance (Schwermetalle im Abwasser--Herkunft und Bedeutung),
W83-02787 5B

BUNDESGESELLSCHAFT FUER WIRTSCHAFT (GERMANY, F.R.).
The Development of the Public Drinking Water Supply in the Federal Republic of Germany in the First Quarter of 1982 (Die Entwicklung Der Offentlichen Trinkwasserversorgung in Der Eundesrepublik Deutschland Im I. Quartal 1982),
W83-02607 5F

BUNDESGESUNDHEITSAMT, BERLIN (GERMANY, F.R.). INST. FUER WASSER-, BODEN- UND LUFTHYGIENE.
Evaluation of the Success of Nutrient-Elimination Measures in Waters With a High Nutrient Content (Bewertung Des Erfolges Von Nahrstoffeliminierungsmassnahmen an Stark Belasteten Gewassern),
W83-02688 5G

BUNDESMINISTERIUM FUER FORSCHUNG UND TECHNOLOGIE, BONN-BAD GODESBERG (GERMANY, F.R.).
Promotion of New Technologies of Wastewater and Sludge Treatment by the Federal Ministry for Research and Technology (Forderung Neuer Technologien Der Abwasser- Und Schlammbehandlung Durch Das Bundesministerium fur Forschung Und Technologie),
W83-02716 5D

BURGEAP S.A., PARIS (FRANCE).
Agricultural Use of Sugar Refinery Wastewater Change in Mineral Nitrogen in Soils Used for Landspreading (Valorisation Agricole Des Effluents En Sucrerie, Etude De L' Evolution De L' Azote Mineral Dans Les Sols Soumis Aux Epandages),
W83-02633 3C

BURNS AND ROE, INC., ORADELL, NJ. HYDRAULIC ENGINEERING DEPT.
Cooling Systems: Can Engineers Save the Fish,
W83-02551 8I

CAISSE CENTRALE DE COOPERATION ECONOMIQUE, PARIS (FRANCE).
Seeking Consumers Cooperation in the Financing of Water Supply (Conditions Permettant Aux Consommateurs A Ressources Limitees De Participer Au Financement De Leur Consommation D Eau),
W83-02634 6C

CALIFORNIA INST. OF TECH., PASADENA. ENVIRONMENTAL QUALITY LAB.
Sludge Disposal in Southern California Basins,
W83-02527 5E

CALIFORNIA STATE UNIV., NORTHRIDGE.
Los Angeles Rainfall Frequencies Change as Record Lengthens,
W83-02472 2B

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD, SACRAMENTO.
Toxic Substances Monitoring Program - 1981,
W83-02719 5A

Aquatic Habitat Program Plan for Assessing the Effects of Pollutants in the San Francisco Bay-Delta Estuary,
W83-02721 5C

CALIFORNIA UNIV., BERKELEY. DIV. OF ENTOMOLOGY AND PARASITOLOGY.
Evaluating the Influence of Geochemical Origin and Drought on Aquatic Biota of the Known Geothermal Resource Area (KGRA) of California,
W83-02725 6G

The Separation of Thermal and Chemical Effects in Evaluating Geothermal Influences on Aquatic Biota,
W83-02738 5C

CALIFORNIA UNIV., BERKELEY. WATER THERMAL AND CHEMICAL TECHNOLOGY CENTER.
Polarization Phenomena in Electrodialysis Systems,
W83-02731 3A

CALIFORNIA UNIV., DAVIS. DEPT. OF LAND, AIR AND WATER RESOURCES.
Drip Irrigation Saves Money in Young Almond Orchards,
W83-02521 3F

Cotton Growth Related to Plant's Water Status,
W83-02576 3F

CALIFORNIA UNIV., IRVINE. DEPT. OF CIVIL ENGINEERING.
Nodal Domain Integration Model of One-Dimensional Advection-Diffusion,
W83-02657 2G

CAMP, DRESSER AND MCKEE, INC., ALBUQUERQUE, NM.
Attacking Odors with H202,
W83-02765 5F

CAMP, DRESSER AND MCKEE, INC., BOSTON, MA.
Much More to Rates Than Tradition,
W83-02781 6C

CAMP, DRESSER AND MCKEE, INC., DALLAS, TX.
Wastewater System Improvements Help Dallas Meet Future Needs,
W83-02771 5D

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
The Use of Rheology for Sludge Characterization,
W83-02757 5D

Fate of Heavy Metals and Potential For Clinker Formation During Pilot Scale Incineration of Municipal Sludge,
W83-02789 5E

CAPE TOWN UNIV. (SOUTH AFRICA). DEPT. OF CHEMICAL ENGINEERING.
Continuous Countercurrent Ion Exchange for Desalination and Tertiary Treatment of Effluents and Other Brackish Waters,
W83-02792 3A

CAPE TOWN UNIV. (SOUTH AFRICA). DEPT. OF WATER RESOURCES AND PUBLIC HEALTH ENGINEERING.
Optimization of Nitrogen Removal in the Single Sludge Activated Sludge Process,
W83-02746 5D

CENTRAL SOIL SALINITY RESEARCH INST., KARNAL (INDIA).
Seasonal Variations in Salt and Water-Content Profiles in Shallow and Saline Groundwater-Table,
W83-02573 3C

CENTRAL WASHINGTON UNIV., ELLENSBURG. DEPT. OF CHEMISTRY.
Acid Precipitation and Lake Susceptibility in the Central Washington Cascades,
W83-02566 2K

CENTRAL WASHINGTON UNIV., ELLENSBURG. DEPT. OF HISTORY.
Come Hell and High Water: Mt. St. Helens and the Federal Response on the Lower Cowlitz River,
W83-02724 4A

CENTRO DI RICERCA IDRAULICA E STRUTTURALE, MILAN (ITALY).
Safety Monitoring of Concrete Dams,
W83-02632 8F

CETEC-ENGINEERING A.G., TURGI (SWITZERLAND).
A Process for the Biological Disinfection of Sludge (Ein Verfahren Zur Biologischen Hygienisierung Von Klarschlamm),
W83-02507 5D

CH2M/HILL, SEATTLE, WA. WATER AND WASTE DIV.
Computer Assisted Analysis to Improve Water System Operation,
W83-02799 5F

CHICAGO BRIDGE AND IRON CO., OAK BROOK, IL.
Study of Ice Crystal Formation in Tubes Under Steady Flow Conditions as Relating to Freeze Desalination,
W83-02481 3A

CINCINNATI UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.
Effects of Nutrient Enrichment on the Colonization and Decompositon of Plant Detritus by the Microbiota of an Arctic Lake,
W83-02563 5C

CLARKSON COLL. OF TECHNOLOGY, POTSDAM, NY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Transport and Fate of Heavy Metals in Onondaga Lake, New York,
W83-02562 5B

CLEMSON UNIV., SC. DEPT. OF AGRICULTURAL ENGINEERING.
Terraced Pasture for Disposal of Dairy Yard Runoff,
W83-02741 5E

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, NH.
Use of Similarity Solutions for the Problem of A Wetting Front - A Question of Unique Representation,
W83-02638 2G

Engineers Assess Aquaculture Systems For Wastewater Treatment - Part II,
W83-02649 5D

COLLINS ENGINEERS, INC., CHICAGO, IL.
Inspection and Maintenance of Dam Dewatering Facilities,
W83-02770 8C

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Field Determination of Infiltration Parameters (Bestimmung von Infiltrationsparametern mit Hilfe von Feldmessungen),
W83-02785 2G

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Economic Issues in Resolving Conflicts in Water Use,
W83-02501 6D

COLORADO UNIV. AT BOULDER. DEPT. OF CIVIL, ENVIRONMENTAL, AND ARCHITECTURAL ENGINEERING.
The Effects of Water Conservation on New Water Supply for Urban Colorado Utilities,
W83-02500 3D

COLUMBIA UNIV., NEW YORK.
Numerical Analysis of the Teton Dam Failure Flood,
W83-02703 2E

COLUMBUS DEPT. OF PUBLIC SERVICE, OH. DIV. OF WATER.
Performance Variability, Ranking, and Selection Analysis of Membrane Filters for Enumerating Coliform Bacteria in River Water,
W83-02690 5A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, FLOREAT PARK (AUSTRALIA). DIV. OF LAND RESOURCES MANAGEMENT.
Kinetic Fractionation of Carbon-13 During Calcium Carbonate Precipitation,
W83-02570 2K

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, SOUTH MELBOURNE (AUSTRALIA). DIV. OF CHEMICAL TECHNOLOGY.
Desalination by Continuous Ion Exchange Based on Thermally Regenerable Magnetic Microresins,
W83-02748 3A

CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.
Feasibility of Inactivating Phosphorus with Aluminum Salts in Ball Pond, CT,
W83-02718 5G

CORNELL UNIV., ITHACA, NY. LAB. OF SOIL MICROBIOLOGY.
Effect of Sorption on Mineralization of Low Concentrations of Aromatic Compounds in Lake Water Samples,
W83-02554 2H

DAVIES AND LOUBSER LTD. (SOUTH AFRICA).
The Construction of the Tugela-Vaal Project Dams,
W83-02643 8A

DELAWARE STATE DEPT. OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL, DOVER. WATER RESOURCES SECTION.
Effluent Limitations Based on Water Quality,
W83-02466 5E

DEPARTMENT OF AGRICULTURE, QUEBEC. RESEARCH STATION.
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W83-02613 2G

DEPARTMENT OF AGRICULTURE, SWIFT CURRENT (SASKATCHEWAN). RESEARCH STATION.
Boron Concentration in the Soil Solution Under Irrigation: A Theoretical Analysis,
W83-02574 2K

DEPARTMENT OF ENERGY, MINES AND RESOURCES, OTTAWA (ONTARIO). SEISMOLOGY AND GEOTHERMAL STUDIES DIV.
Seismicity Induced by the Reservoir LG-2 (La Seismicite Provoquee Au Reservoir LG-2)
W83-02575 8D

DEPARTMENT OF WATER AFFAIRS, FORESTRY AND ENVIRONMENTAL CONSERVATION, PRETORIA (SOUTH AFRICA).
The Drakensberg Project: Water and Power for South Africa,
W83-02647 6D

The Dams of the Tugela-Vaal Project,
W83-02648 8A

Environmental Considerations of the Drakensberg Pumped Storage Scheme,
W83-02664 6G

DORSCH CONSULT G.M.B.H., MUNICH (GERMANY, F.R.).
Use of the Extremal-3 Distribution in Precipitation Evaluation and Low Water Analysis (Die Anwendung Der Extremal-3-Verteilung Bei Der Regenauswertung Und Der Niedrigwasseranalyse),
W83-02590 2B

DORTMUNDER STADTWERKE A.G. (GERMANY, F.R.).
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W83-02717 5G

DOW CHEMICAL CO., MIDLAND, MI.
Aqueous Odor and Taste Threshold Values of Industrial Chemicals,
W83-02684 5A

DUGWAY PROVING GROUND, UT. ENVIRONMENTAL AND LIFE SCIENCE DIV.
Protamine Precipitation of Two Reovirus Particle Types From Polluted Waters,
W83-02555 5A

DUNDEE UNIV. (SCOTLAND). DEPT. OF BIOLOGICAL SCIENCES.
Isolation of New Types of Sulphate-Reducing Bacteria from Estuarine and Marine Sediments Using Chemostat Enrichments,
W83-02700 5A

EAST BAY MUNICIPAL UTILITY DISTRICT, OAKLAND, CA.
Keeping Clean Water Clean,
W83-02780 5F

ECOLE NATIONALE SUPERIEURE DE CHIMIE DE RENNES (FRANCE).
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W83-02755 5D

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PCBs in Lake Geneva (Lake Leman) Fish,
W83-02513 5C

EDINBURGH UNIV. (SCOTLAND). DEPT. OF CHEMISTRY.
The Determination of Lead in Tapwater by Resin Preconcentration Followed by Flame Atomic Absorption Spectrometry,
W83-02636 5A

EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ABWASSERREINIGUNG UND GEWAESSERSCHULTZ, DUEBENDORF (SWITZERLAND).
Persistent Organic Chemicals in Sewage Effluents. 2. Quantitative Determinations of Nonylphenols and Nonylphenol Ethoxylates by Glass Capillary Gas Chromatography,
W83-02529 5A

Decomposition of Ozone in Water: Rate of Initiation by Hydroxide Ions and Hydrogen Peroxide,
W83-02577 5F

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND). INST. FUER HYDROMECHANIK UND WASSERWIRTSCHAFT.
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W83-02760 8A

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W83-02788 6G

ELECTRICITY SUPPLY COMMISSION, JOHANNESBURG (SOUTH AFRICA).
The Design of Drakensberg,
W83-02541 8A

Aspects of the Machine Foundation Design at Drakensberg,
W83-02667 8C

The Drakensberg Pumped Storage Scheme Description of Scheme and Principal Data,
W83-02671 8A

ELECTROCONSULT, MILAN (ITALY).
Spillway Aeration of the San Roque Project,
W83-02540 8B

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH.
Treatment of Drinking Water Containing Trichloroethylene and Related Industrial Solvents,
W83-02685 5D

ENVIRONMENTAL RESEARCH AND TECHNOLOGY, INC., CONCORD, MA.
Detection of Rainfall Rates Utilizing Spaceborne Microwave Radiometers,
W83-02798 2B

EXXON PRODUCTION RESEARCH CO., HOUSTON, TX.
Well Hydraulics in Vertically Heterogeneous Formations,
W83-02693 2F

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Surface Temperature Model for Evaporation Pans (Modelisation De La Temperature De Surface Des Bacs Evaporometriques),
W83-02673 2D

FILMTEC CORP., MINNEAPOLIS, MN.
Development of FT-30 Membranes in Spiral Wound Modules,
W83-02722 3A

FISH AND WILDLIFE SERVICE, LAUREL, MD. PATUXENT WILDLIFE RESEARCH CENTER.
Isolation of Hydrocarbon Residues From Sediment by Steam Distillation,
W83-02514 5A

FLORIDA UNIV., GAINESVILLE. DEPT. OF AGRICULTURAL ENGINEERING.
Automatic Tensiometer Scanner for Rapid Measurements,
W83-02458 7B

FLORIDA UNIV., GAINESVILLE. DEPT. OF CIVIL ENGINEERING.
Application of the Aquifer's Average Characteristics for Determining the Onset of Thermohaline Convection in a Heterogeneous Aquifer,
W83-02674 2F

Thermohaline Convection in a Nonhomogeneous Aquifer,
W83-02675 2F

FOOD AND DRUG ADMINISTRATION, WINCHESTER, MA. WINCHESTER ENGINEERING AND ANALYTICAL CENTER.
Determination of Radium-228 in Foods and Water,
W83-02686 5A

GENERAL ELECTRIC CO., PHILADELPHIA, PA. SPACE SYSTEMS DIV.
Muskingum-Like Approximations for Water Routing,
W83-02696 2E

GEOLOGICAL SURVEY, MADISON, WI. WATER RESOURCES DIV.
Sediment Deposition in a Flood-Retention Structure After Two Record Floods in Southwestern Wisconsin,
W83-02705 4D

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Adsorption of Natural Dissolved Organic Matter at the Oxide/Water Interface,
W83-02584 2K

GEOLOGICAL SURVEY, NSTL STATION, MS.
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W83-02645 5B

GEOLOGICAL SURVEY, RESTON, VA.
Flow Computation Using Extrapolation Procedures,
W83-02695 2E

GEOTEAM A/S, OSLO (NORWAY).
Surge Chamber Design for Jukla,
W83-02572 8E

GESELLSCHAFT FUER STRAHLEN- UND UMWELTFORSCHUNG M.B.H. MUENCHEN, FREISING-WEIHENSTEPHAN (GERMANY, F.R.).
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W83-02608 5B

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W83-02668 8F

GULF SOUTH RESEARCH INST., NEW ORLEANS, PA. POLYMER DEPT.
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W83-02502 3A

HANOVER UNIV. (GERMANY, F.R.). LEHRSTUHL FUER STROEMUNGSMECHANIK.
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W83-02637 2L

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Inspecting, Painting, and Maintaining Steel Water Tanks,
W83-02713 8G

HAVFORSKINGSINSTUTT, BERGEN (NORWAY).
Mercury Concentration in Liver and Muscle of Cod (Gadus Morhua) as an Evidence of Migration Between Waters With Different Levels of Mercury,
W83-02553 5B

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Volatile Organic Compounds in Water At Thirty Canadian Potable Water Treatment Facilities,
W83-02715 5A

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W83-02538 8C

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W83-02522 3A

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W83-02653 6E

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The Genesis of a Numerical Model for the Study of the Hydrogeology of a Steep Hillside in Hong Kong,
W83-02474 2A

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Czechoslovakia's Largest Pumped-Storage Plant,
W83-02542 8A

IDAHO UNIV., MOSCOW. COLL. OF MINES AND EARTH RESOURCES.
Preliminary Assessment of Ground Water Management Alternatives for Idaho,
W83-02726 4B

IDAHO UNIV., MOSCOW. DEPT. OF CIVIL ENGINEERING.
Remote Sensing Determination of Hydrograph Recession Characteristics,
W83-02487 2A

Experience Curves for Feasibility Studies and Planning of Modern Low-Head Hydro Turbines,
W83-02489 8C

IDAHO UNIV., MOSCOW. DEPT. OF ENGINEERING SCIENCE.
Identification of Snowcover Depletion Patterns Using Satellite Imagery,
W83-02488 2C

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W83-02516 5G

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W83-02720 5F

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A Model for Drainage Benefits,
W83-02452 4A

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The Removal of Nitrilotriacetic Acid and its Effect on Metal Removal During Biological Sewage Treatment: Part I - Adsorption and Acclimatisation,
W83-02579 5D

Role of Bacterial Extracellular Polymers in Metal Uptake in Pure Bacterial Culture and Activated Sludge-I. Effects of Metal Concentration,
W83-02767 5D

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W83-02571 3B

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W83-02512 5F

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W83-02526 3A

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W83-02578 5B

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W83-02612 2I

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W83-02756 5D

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W83-02532 6D

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W83-02676 5A

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W83-02626 6G

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INTASA, INC., MENLO PARK, CA.
An Evalution Framework for Assessing Variations in the Costs and Benefits of Municipal Water Conservation,
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W83-02549 5B

NATIONAL RESEARCH COUNCIL, WASHINGTON, DC.
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W83-02546 5F

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W83-02651 1A

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W83-02739 2D

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Recreation in the Perceived Community Function Perspective,
W83-02740 6B

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Extractive Spectrophotometric Determination of Nitrate in Polluted Waters,
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Halting Creek Pollution,
W83-02768 5B

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Comparison of the Dry Substance of Seston and the Potassium Permanganate Consumption in the Raw Water for the Drinking Water Supply of the Town of Rostock (Vergleich Der Sestontrockenmasse Und Des Kalium Permanganatverbrauchs in Rohwasser Der Trinkwasserversorgung Rostocks),
W83-02641 5F

RUHRVERBAND, ESSEN (GERMANY, F.R.). CHEMISCHES UND BIOLOGISCHES LAB.
Significance of River Flow for the Suspended Solids Burden and its Retention in the Impounded Ruhr (Bedeutung Des Abflusses Fur Die Schwebstofffracht Und Ihre Retention in Der Gestauten Ruhr),
W83-02587 2J

SAINT LOUIS CITY WATER DIV., MO.
Designing and Installing Large Steel Water Mains to Prevent Failures,
W83-02710 5F

SAINT LOUIS COUNTY WATER CO., UNIVERSITY CITY, MO.
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W83-02714 8C

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Lateral Bed Load Transport on Side Slopes,
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W83-02796 5B

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Survey of Polyelectrolyte Coagulant Use in the United States,
W83-02691 5F

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Instrumenting Australia's Cethana Dam,
W83-02603 8A

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Lake Fidler, a Meromictic Lake in Tasmania,
W83-02557 2H

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W83-02752 5D

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Project Studies and Research Work Concerning Butterfly Valves as Used in Water Power Stations and Retarding Basins (Planungskriterien Und Forschung Bei Drosselklappen Fur Kraftwerksanlagen Und Ruckhaltebecken),
W83-02761 8C

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The Economic Efficiency of Flood Plain Development,
W83-02477 6F

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Plant-Substrate Interactions and Below Substrate Biomas Dynamics: A Continuation of Studies Concerning Potential Restriction of the Introduced Aquatic Weed Myriophyllum , Spicatum L. (Eurasian Water Milfoil),
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Analysis of a Finite Element Algorithm for Numerical Predictions in Water Resources Research,
W83-02656 8B

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Flow Measurements at Raccoon Mountain,
W83-02535 8C

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Responsibility for Runoff Control,
W83-02467 6E

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W83-02681 5F

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A Preliminary Quantification of the Impacts of Aspen to Conifer Succession on Water Yield Within the Colorado River Basin (A Process Aggravating the Salt Pollution Problem),
W83-02737 2D

UTAH STATE UNIV., LOGAN. DEPT. OF AGRICULTURAL AND IRRIGATION ENGINEERING.
Drainage Coefficients,
W83-02454 4A

VALENCIA UNIV. (SPAIN).
Contamination of the Mediterranean Coast and its Control as a Problem of Land Management (La Contaminacion Litoral Mediterranea Y su Correccion Como un Problema De La Ordenacion Territorial),
W83-02777 5B

VANDERBILT UNIV., NASHVILLE, TN. DEPT. OF CHEMICAL ENGINEERING.
Ozonalysis for Water Reuse Applications,
W83-02498 5F

VEB WASSERVERSORGUNG UND ABWASSERBEHANDLUNG, DRESDEN (GERMAN D.R.).
The Potentiometric Titration of Sulfide in Wastewater Using A Sensitive Electrode (Die Potentiometrische Titration Von Sulfid in Abwasser Mit Hilfe Einer Sensitiven Elektrode),
W83-02639 5A

VSESOYUZNYI NAUCHNO-ISSLEDOVATEL'SKII INST. GIDROGEOLOGII I INZHENERDOI GEOLOGII, MOSCOW (USSR).
Hydrodynamic Conditions for Computer Simulation of Physicochemical Interactions in a Water-Rock System in Hydrogeochemical Forecasting: Application to CaF2 with Solutions of Various Compositions,
W83-02617 2K

WAHLER ASSOCIATES, PALO ALTO, CA.
Seismic Safety Analysis of Lower Crystal Springs Dam: A Case History,
W83-02663 8E

WAHNBACHTALSPERRENVERBAND, SIEGBURG (GERMANY, F.R.).
The Effects of Limnological Processes on the Quality of Impounded Waters (Auswikungen Limnologischer Vorgange Auf Die Beschaffenheit Von Staugewassern),
W83-02784 2H

WASHINGTON UNIV., SEATTLE. DEPT. OF ENVIRONMENTAL HEALTH.
Organic Carbon Removal by Advanced Waste water Treatment Processes,
W83-02528 5D

WASHINGTON UNIV., SEATTLE. SCHOOL OF FISHERIES.
Carbon Inputs to Bivalve Mollusks: A Comparison of Two Estuaries,
W83-02548 2L

WASSERWIRTSCHAFTSDIREKTION SAALE-WERRA, ERFURT (GERMAN D.R.).
Investigations on Seasonal Variations of Saprobity in Flowing Water (Untersuchungen Uber Jahreszeitliche veranderungen Der Saprobitat in Einem Fliessgewasser),
W83-02640 5B

WATER AND POWER RESOURCES SERVICE, SACRAMENTO, CA.
Rock Balls at Folsom Dam, California,
W83-02661 8F

WATER RESEARCH CENTRE, STEVENAGE (ENGLAND).
Field Performance of RBC'S.
W83-02533 5D

WATER SERVICES OF AMERICA, INC., MILWAUKEE, WI.
World's First Solar Powered Reverse Osmosis Desalination Plant,
W83-02547 3A

WATERLOOPKUNDIG LAB., DELFT (NETHERLANDS).
Computation of Flow Patterns in Rivers,
W83-02692 2E

WAUKESHA CITY WATER UTILITY, WI.
Valve and Hydrant Maintenance,
W83-02782 5F

WELSH WATER AUTHORITY, POWYS (WALES). DIRECTORATE OF SCIENTIFIC SERVICES.
Aerobic Thermophilic Digestion of Sewage Sludge,
W83-02568 5E

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF CHEMISTRY.
Measuring Chlorine Dioxide With a Rotating Voltammetric Membrane Electrode.
W83-02682 5A

WESTERN LAKE SUPERIOR SANITARY DISTRICT, DULUTH, MN.
Start-Up and Operation of an Oxygen-Activated Advance Wastewater Treatment System,
W83-02680 5D

WESTFAELISCHE BERGGEWERKSCHAFTSKASSE, BOCHUM (GERMANY, F.R.).
Oxidation of Iron (II) Salts in Mine Waters Using Bacteria (Eisen (II)-Salz-Oxidation in Grubenwassern Mit Bakterien),
W83-02592 5D

WILLIAMSPORT SANITARY AUTHORITY, PA. WASTEWATER DIV.
Aquatic Invaders,
W83-02766 5F

Superbugs: Bacteria for Wastewater Treatment Plants,
W83-02769 5D

WISCONSIN UNIV.-SUPERIOR. CENTER FOR LAKE SUPERIOR ENVIRONMENTAL STUDIES.
Assessment of Surface Water quality at Slected Northwestern Wisconsin Sites by Combined Biological and Chemical Techniques,
W83-02736 5A

ZOOLOGISCHES INST. UND MUSEUM, HAMBURG (GERMANY, F.R.).
Biomass of Marine Macrofauna Communities in a Dumping Area of Sewage Sludge Near the Elbe Estuary (Die Biomasse Mariner Makrobenthos-Gesellschaften im Bemundung),
W83-02627 5C

ACCESSION NUMBER INDEX

W83-02451 5A
W83-02452 4A
W83-02453 4D
W83-02454 4A
W83-02455 4D
W83-02456 2G
W83-02457 7B
W83-02458 7B
W83-02459 2G
W83-02460 5A
W83-02461 5B
W83-02462 6G
W83-02463 2L
W83-02464 2H
W83-02465 2L
W83-02466 5E
W83-02467 6E
W83-02468 5F
W83-02469 5D
W83-02470 2H
W83-02471 5B
W83-02472 2B
W83-02473 6C
W83-02474 2A
W83-02475 2L
W83-02476 2A
W83-02477 6F
W83-02478 5B
W83-02479 6D
W83-02480 6G
W83-02481 3A
W83-02482 2H
W83-02483 2F
W83-02484 5F
W83-02485 3C
W83-02486 3A
W83-02487 2A
W83-02488 2C
W83-02489 8C
W83-02490 5B
W83-02491 2C
W83-02492 5B
W83-02493 6B
W83-02494 5C
W83-02495 2F
W83-02496 5A
W83-02497 2K
W83-02498 5F
W83-02499 3F
W83-02500 3D
W83-02501 6D
W83-02502 3A
W83-02503 5D
W83-02504 5G
W83-02505 5D
W83-02506 5D
W83-02507 5D
W83-02508 5D
W83-02509 5F
W83-02510 5F
W83-02511 5D
W83-02512 5F
W83-02513 5C
W83-02514 5A
W83-02515 5D
W83-02516 5G
W83-02517 5E
W83-02518 5A
W83-02519 5A
W83-02520 5B
W83-02521 3F
W83-02522 3A
W83-02523 3A
W83-02524 3A
W83-02525 3A
W83-02526 3A
W83-02527 5E
W83-02528 5D
W83-02529 5A
W83-02530 5D
W83-02531 5F
W83-02532 6D
W83-02533 5D
W83-02534 8C
W83-02535 8C
W83-02536 8C
W83-02537 8G
W83-02538 8C
W83-02539 8A
W83-02540 8B
W83-02541 8A
W83-02542 8A
W83-02543 8A
W83-02544 4D
W83-02545 5B
W83-02546 5F
W83-02547 3A
W83-02548 2L
W83-02549 5B
W83-02550 2A
W83-02551 8I
W83-02552 5E
W83-02553 5B
W83-02554 2H
W83-02555 5A
W83-02556 2H
W83-02557 2H
W83-02558 5G
W83-02559 5C
W83-02560 5F
W83-02561 5G
W83-02562 5B
W83-02563 5C
W83-02564 5D
W83-02565 5B
W83-02566 2K
W83-02567 2K
W83-02568 5E
W83-02569 5C
W83-02570 2K
W83-02571 3B
W83-02572 8E
W83-02573 3C
W83-02574 2K
W83-02575 8D
W83-02576 3F
W83-02577 5F
W83-02578 5B
W83-02579 5D
W83-02580 5D
W83-02581 5A
W83-02582 5C
W83-02583 2K
W83-02584 2K
W83-02585 2K
W83-02586 2K
W83-02587 2J
W83-02588 5F
W83-02589 5F
W83-02590 2B
W83-02591 5D
W83-02592 5D
W83-02593 8E
W83-02594 8A
W83-02595 8E
W83-02596 8H
W83-02597 8A
W83-02598 5B
W83-02599 5B
W83-02600 2K
W83-02601 2L
W83-02602 5C
W83-02603 8A
W83-02604 6G
W83-02605 2J
W83-02606 6G
W83-02607 5F
W83-02608 5B
W83-02609 5A
W83-02610 2H
W83-02611 2J
W83-02612 2I
W83-02613 2G
W83-02614 8B
W83-02615 5F
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W83-02617 2K
W83-02618 5F
W83-02619 5D
W83-02620 8C
W83-02621 2C
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W83-02626 6G
W83-02627 5C
W83-02628 8D
W83-02629 8D
W83-02630 8G
W83-02631 8B
W83-02632 8F
W83-02633 3C
W83-02634 6C
W83-02635 5A
W83-02636 5A
W83-02637 2L
W83-02638 2G
W83-02639 5A
W83-02640 5B
W83-02641 5F
W83-02642 5B
W83-02643 8A
W83-02644 8E
W83-02645 5B
W83-02646 5B
W83-02647 6D
W83-02648 8A
W83-02649 5D
W83-02650 6A
W83-02651 1A
W83-02652 6C
W83-02653 6E
W83-02654 5A
W83-02655 8A
W83-02656 8B
W83-02657 2G
W83-02658 2E
W83-02659 5C
W83-02660 5C
W83-02661 8F
W83-02662 5G
W83-02663 8E
W83-02664 6G
W83-02665 8A
W83-02666 8A
W83-02667 8C
W83-02668 8F
W83-02669 5B
W83-02670 5A
W83-02671 8A
W83-02672 8B
W83-02673 2D
W83-02674 2F
W83-02675 2F
W83-02676 5A
W83-02677 8B
W83-02678 8B
W83-02679 8B
W83-02680 5D
W83-02681 5F
W83-02682 5A
W83-02683 5D
W83-02684 5A
W83-02685 5D
W83-02686 5A
W83-02687 5A
W83-02688 5G
W83-02689 5F
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W83-02691 5F
W83-02692 2E
W83-02693 2F
W83-02694 2J
W83-02695 2E
W83-02696 2E
W83-02697 2J
W83-02698 2J
W83-02699 2C
W83-02700 5A
W83-02701 2F
W83-02702 2E
W83-02703 2E
W83-02704 2J
W83-02705 4D
W83-02706 2A
W83-02707 5B
W83-02708 5A
W83-02709 8B
W83-02710 5F
W83-02711 5B
W83-02712 5F
W83-02713 8G
W83-02714 8C
W83-02715 5A
W83-02716 5D
W83-02717 5G
W83-02718 5G
W83-02719 5A
W83-02720 5F
W83-02721 5C
W83-02722 3A
W83-02723 5B
W83-02724 4A
W83-02725 6G
W83-02726 4B
W83-02727 5F
W83-02728 3B
W83-02729 2I
W83-02730 2F
W83-02731 3A
W83-02732 6B
W83-02733 5E
W83-02734 2J
W83-02735 2L
W83-02736 5A
W83-02737 2D
W83-02738 5C
W83-02739 2D
W83-02740 6B
W83-02741 5E
W83-02742 5D
W83-02743 6B
W83-02744 9D
W83-02745 3A
W83-02746 5D
W83-02747 5D
W83-02748 3A
W83-02749 5D
W83-02750 5D
W83-02751 5D
W83-02752 5D
W83-02753 5D
W83-02754 5D
W83-02755 5D
W83-02756 5D
W83-02757 5D
W83-02758 5G
W83-02759 5G
W83-02760 8A
W83-02761 8C
W83-02762 3B
W83-02763 6D
W83-02764 5C
W83-02765 5F
W83-02766 5F
W83-02767 5D
W83-02768 5B
W83-02769 5D
W83-02770 8C
W83-02771 5D
W83-02772 5D
W83-02773 5D
W83-02774 2C
W83-02775 2C
W83-02776 2K
W83-02777 5B
W83-02778 1B
W83-02779 2A
W83-02780 5F
W83-02781 6C
W83-02782 5F
W83-02783 5B
W83-02784 2H
W83-02785 2G
W83-02786 6E

W83-02787

W83-02787 5B
W83-02788 6G
W83-02789 5E
W83-02790 5F
W83-02791 5E
W83-02792 3A
W83-02793 2K
W83-02794 5F
W83-02795 8A
W83-02796 5B
W83-02797 2I
W83-02798 2B
W83-02799 5F
W83-02800 8C

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

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